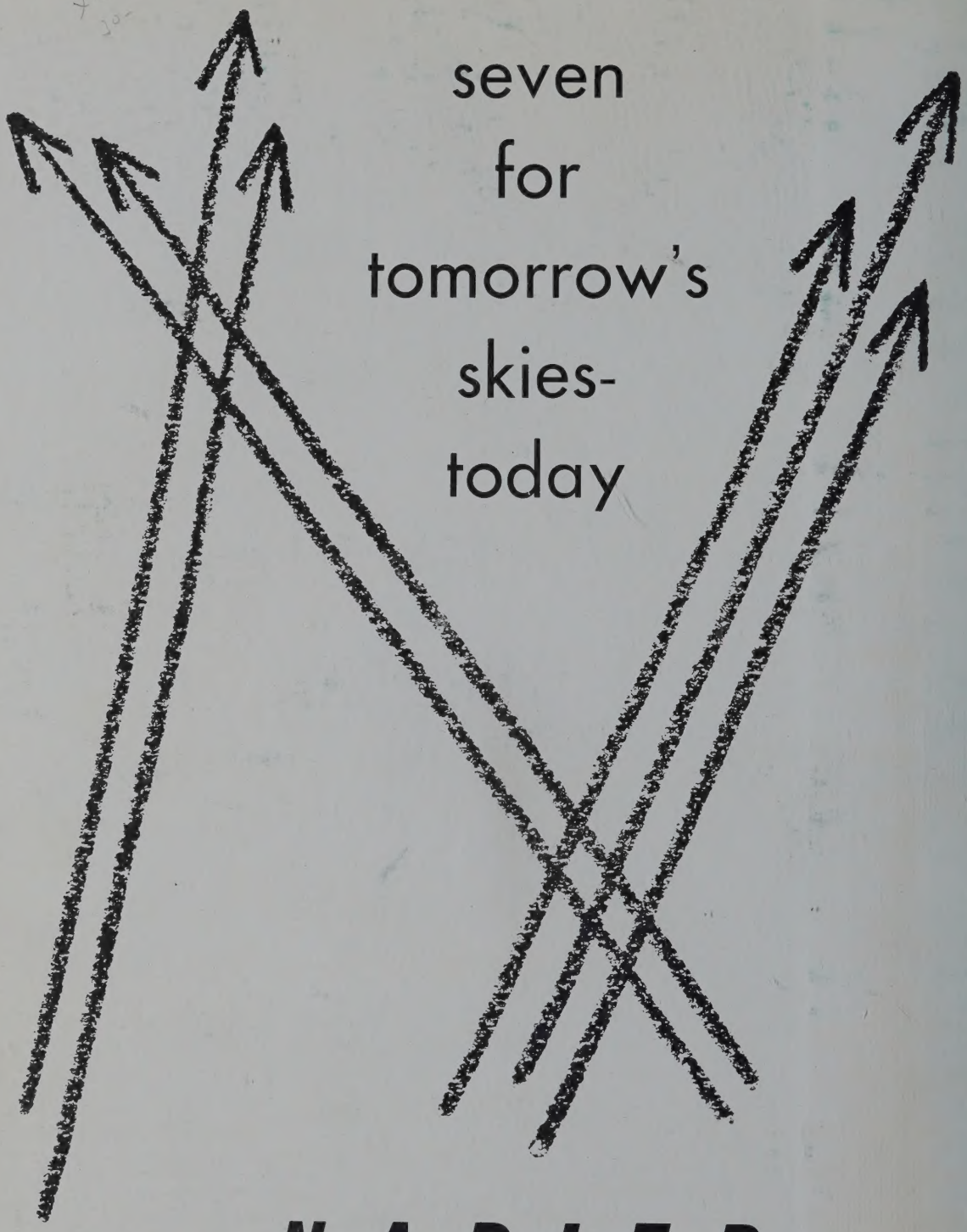
JANE'S ALL THE WORLD'S AIRCRAFT

1957-1958



seven for tomorrow's skies- today

NAPIER

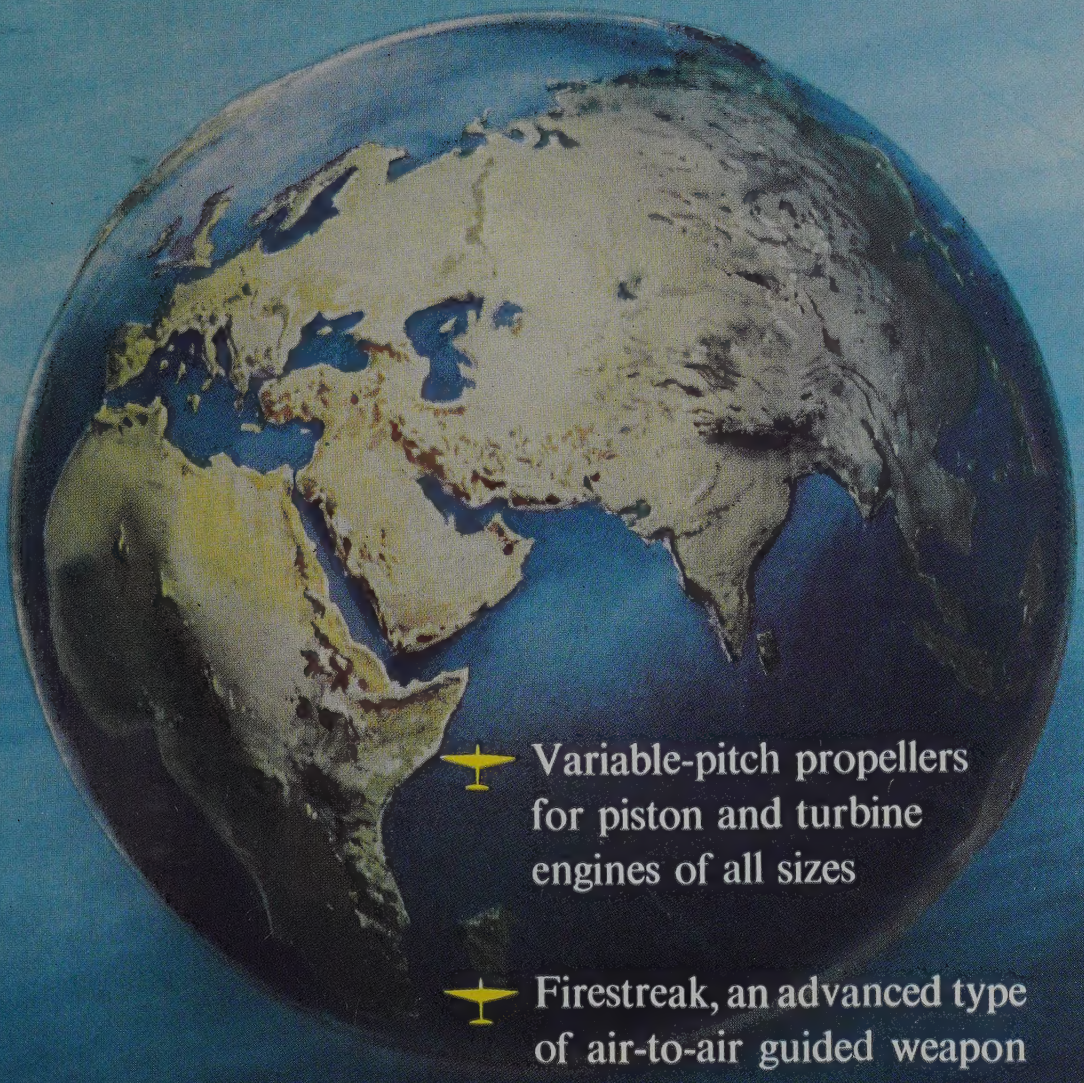
NAPIER ELAND turbo-prop for short and medium-haul airliners
NAPIER GAZELLE—a rugged new free turbine for helicopters
NAPIER ORYX tubo-gas unit for helicopters—eliminates all mechanical transmission
NAPIER TIP THRUST UNITS—extra power for helicopters
NAPIER SCORPION Rocket Engine—for high performance at great altitudes
NAPIER RAM JETS—for high supersonic speeds
NAPIER SPRAYMAT—electrical de-icing sprayed on

D. NAPIER & SON LIMITED LONDON, W.3.
Partners in Progress with The ENGLISH ELECTRIC Company Ltd

CRC 531

REFERENCE ONLY

A MAJOR MEMBER OF THE WORLD-WIDE ENTERPRISE



- Variable-pitch propellers for piston and turbine engines of all sizes
- Firestreak, an advanced type of air-to-air guided weapon
- Aircraft air-conditioning systems for civil and military aircraft
- Radar scanners

DE HAVILLAND PROPELLERS

D H PROPELLERS



rotors and rockets...

...are today's news; tomorrow—who knows? Such is the rate of development in modern aviation.
To keep you abreast of progress week by week, FLIGHT provides the quickest possible reports of every important new step in research, design and operation of the world's military and civil aircraft. Informative articles, detailed technical drawings and brilliant photographs combine to make this the world's foremost aviation journal.

FLIGHT

every Friday 1s 6d

AIRCRAFT PRODUCTION records the most modern processes of aircraft, engine and component production—an essential service in an industry where constant design changes call for new machines, methods and materials. Each issue contains information which can be put to valuable use by everyone in the industry.

AIRCRAFT PRODUCTION

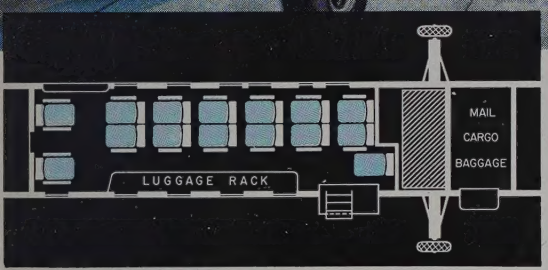
Monthly 2s 6d

New Vertol helicopter seats 19 passengers, doubles as freighter

For the first time, a large capacity helicopter, the Vertol 44, is available to commercial operators. And it comes with a selection of interiors suited for airline operation, executive transportation, or combination passenger-freight use.

Based on the design of the famous Vertol H-21, which has been flown more than 100,000 hours by the military services of the United States, Canada, France and West Germany, the Vertol 44 offers the versatility and cabin capacity long lacking in civilian helicopter operation.





Cabin layout shows 15 luxury seats in Vertol 44 airliner version.

Engineers, if you are not already working for the government or defense industry, investigate job opportunities with Vertol.

Check these new Vertol 44 features:

- Highest useful load, greatest seating capacity, lowest seat-mile cost in commercial helicopter field. Tandem rotor design allows passengers to sit any place in cabin and eliminates balance problem in placement of cargo.
- Internal capacity, approximately 600 cu. ft. of freight in cargo version. Can carry 2½ tons on external cargo sling.
- Capacity for 19 passengers, using high density seating arrangement. Luxury seats for 15 in airline version with large window next to every seat. Seats fold away for conversion in minutes to cargo configuration.
- Two large doors permit quick and easy loading and unloading; rear door folds down with integral stairway.
- Better high altitude performance with two-speed engine supercharger.

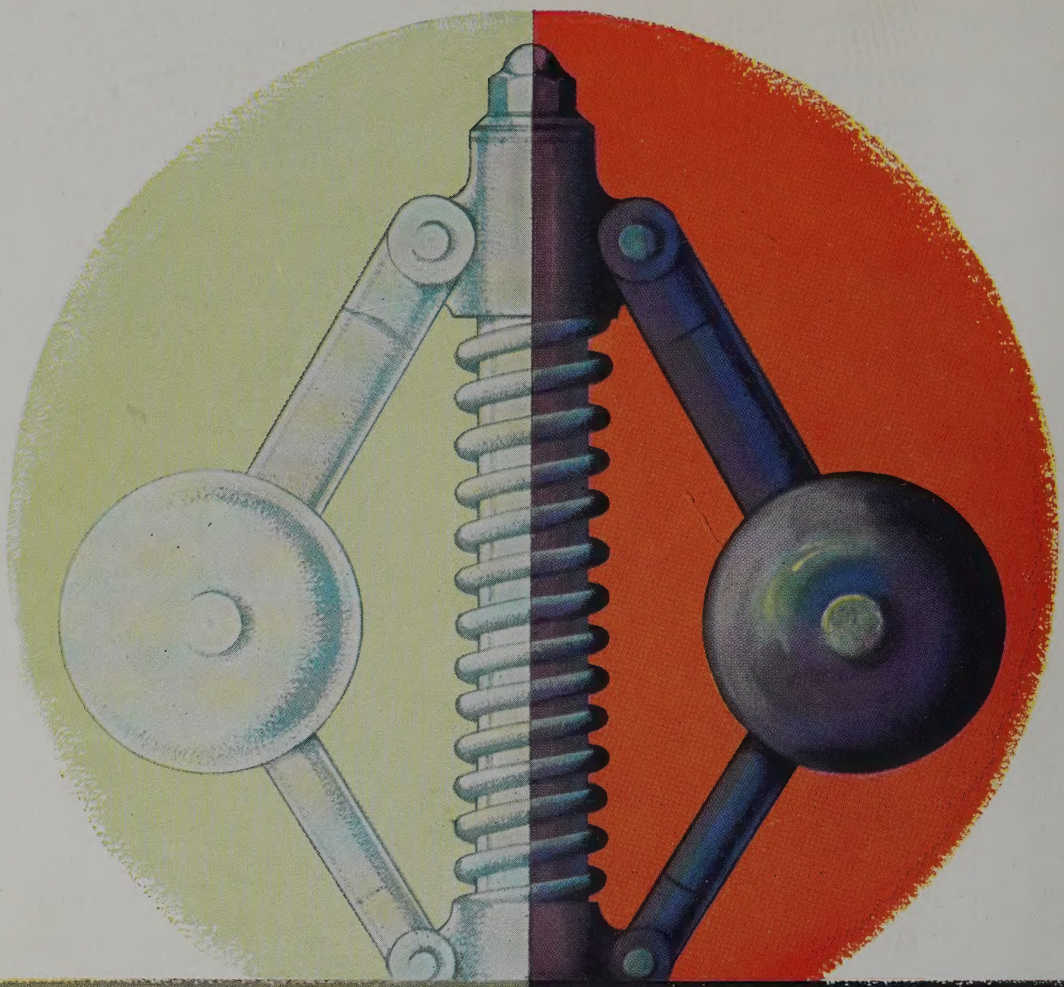
For detailed information on the Vertol 44 write to:

Customer Relations Manager

VERTOL *Aircraft Corporation*

MORTON, PENNSYLVANIA

4 adv.



ACCURATE **ROBUST**

Evolved after many years of specialization, the Iso-Speedic governor controls speed to an extraordinary degree of accuracy, due to the elimination of static friction by rolling flybobs.

Iso-Speedic governors can be supplied which control speed within 0.3 per cent: others are available where a lower degree of accuracy is sufficient.

THE ISO-SPEEDIC COMPANY LTD., FRIAR'S ROAD, COVENTRY
Telephone: Coventry 3147 Telegrams: Isospeedic Coventry

Iso-Speedic

JANE'S
ALL THE WORLD'S AIRCRAFT

EDITORIAL OFFICES:

All communications for the Editor should be addressed to:

THE EDITOR, JANE'S ALL THE WORLD'S AIRCRAFT,
25, GILBERT STREET, LONDON, W.1.

ADVERTISEMENT OFFICES:

All communications in regard to advertising should be addressed to:

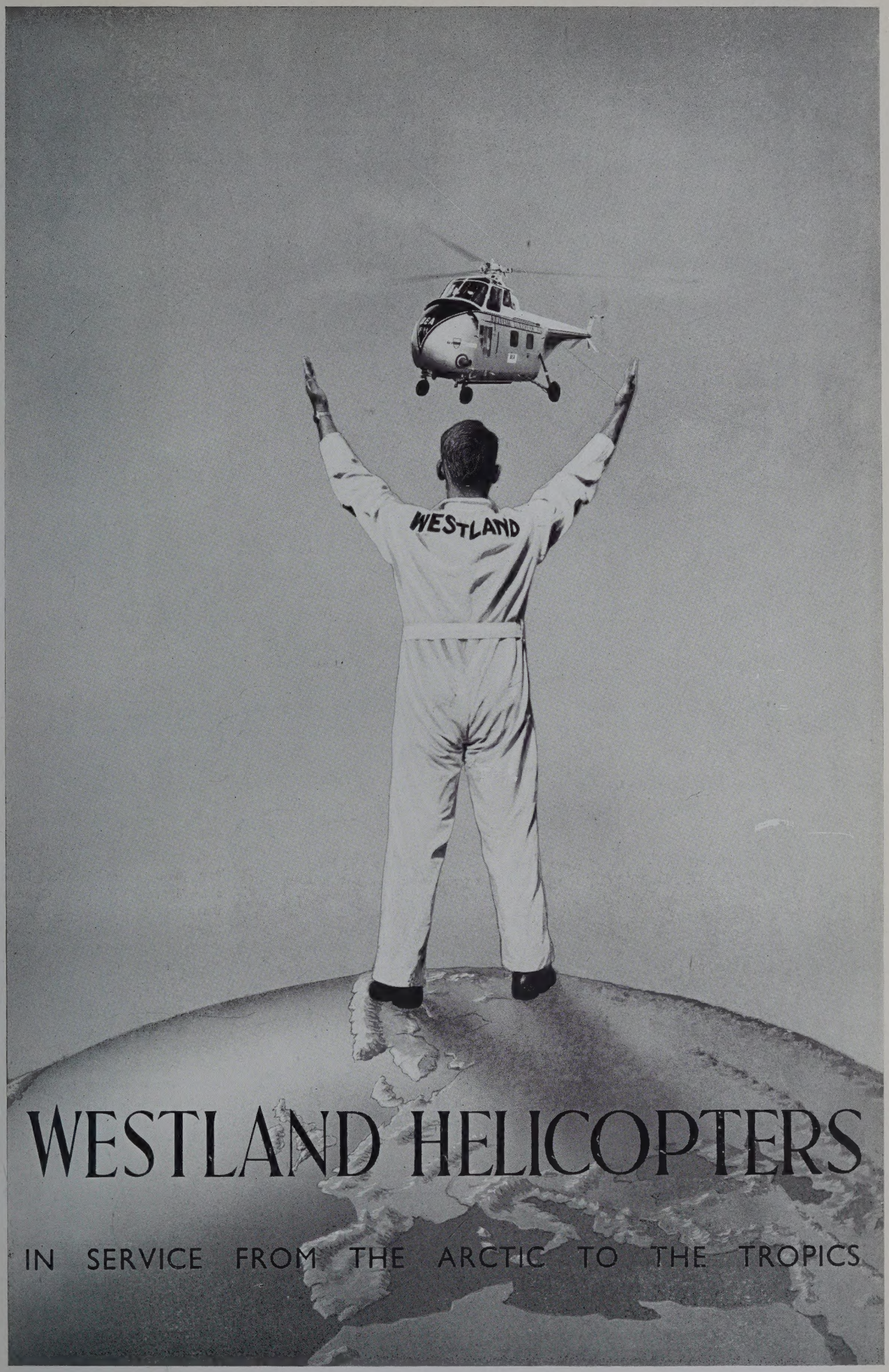
THE ADVERTISEMENT MANAGERS, JANE'S ALL THE WORLD'S AIRCRAFT,
THE TRADE PRESS ASSOCIATION LTD., "BERNERS HOUSE," 47-48, BERNERS STREET, LONDON, W.1



ALPHABETICAL LIST OF ADVERTISERS.

1957/8 EDITION.

	PAGE
A.B.C. Motors Ltd.	88 adv.
Aero Research Ltd.	112 „
Air Trainers Ltd.	89 „
Alvis Ltd.	113 „
Amal Ltd.	27 „
Anglo-American Aviation Co.	87 „
Automotive Products Co., Ltd. (Avery Wheels and Lockheed Equipment)	28 „
Avco—Lycoming (U.S.A.)	111 „
Aviation Traders Ltd.	34 „
Avions Hurel-Dubois (France)	84 „
Avro Aircraft Ltd.	120 „
BP Aviation Service	55 „
Barr & Stroud Ltd.	*Inside back cover*
Bell Aircraft Corporation (U.S.A.)	82 adv.
Bellman Hangars Ltd.	109 „
Blackburn and General Aircraft Ltd.	66 „
Boeing Aircraft (U.S.A.)	10 „
Boorn, Thomas & Co., Ltd.	51 „
Boulton Paul Aircraft Ltd.	64 „
Bristol Aeroplane Co., Ltd., The	95 & 96 „
British Aviation Insurance Co., Ltd., The	59 „
British Aviation Services Ltd.	59 „
British Insulated Callender's Cables Ltd.	105 „
British Oxygen Aro Equipment Ltd.	49 „
British Petroleum Co., Ltd., The	55 „
British Thomson-Houston Co., Ltd., The	61 „
Brown, David Foundries Co., The	39 „
Brown, David, Tractors Ltd.	31 „
Brown, S. G., Ltd.	88 „
Brush Crystal Co., Ltd.	37 „
Bryans Aeroquipment Ltd.	63 „
Burnley Aircraft Products Ltd.	65 „
Butlers Ltd.	42 „
Cellon Ltd.	57 „
Convair (A Division of General Dynamics Corporation) (U.S.A.)	106 „
Continental Motors Corporation (U.S.A.)	114 „
Cornercroft Group of Companies, The	6 „
Curran, John, Ltd.	83 „
de Havilland Enterprise, The	2, 25 & 108 „
Desoutter Bros., Ltd.	14 „
Dobbie McInnes Ltd.	85 „
Dragonair Ltd.	86 „
Dunlop Rubber Co., Ltd.	104 „
Edwards, F. J., Ltd.	9 „
Elliot Equipment Ltd.	45 „
English Electric Co., Ltd., The	22 & 90 „
Esavian Ltd.	92 adv.
Esso Aviation Products	116 „
Fairchild Engine & Airplane Corporation (U.S.A.)	30 „
Fairey Aviation Co., Ltd., The	62 „
Ferranti Ltd.	67 „
Fiat Servizio Stampa (Italy)	38 „
Fokker, Royal Netherlands Aircraft Factories (Holland)	80 „
Folland Aircraft Ltd.	98 „
Fox, Samuel & Co., Ltd.	117 „
G. Q. Parachute Co., Ltd., The	56 „
Garringtons Ltd.	60 „
Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The	58 „
H.M.L. (Engineering) Ltd.	43 „
Habershon, J. J. & Sons, Ltd.	69 „
Handley Page Ltd.	99 „
Hawker Siddeley Group Ltd.	115 „
Heenan & Froude Ltd.	12 „
High Duty Alloys Ltd.	102 „
Hindustan Aircraft Ltd. (India)	78 „
Hispano Suiza (France)	36 „
Hobson, H. M., Ltd.	71 „
Hunting Percival Aircraft Ltd.	54 „
Iliffe & Sons Ltd.	3 „
Integral Ltd.	85 „
Irving Air Chute of Great Britain Ltd., The	73 „
Iso-Speedic Co., Ltd., The	5 „
Jack & Heintz, Inc. (U.S.A.)	53 „
Jessop, William & Sons, Ltd.	110 „
Kidde, Walter Co., Ltd., The	35 „
Kollsman Instrument Corporation (U.S.A.)	100 „
Low Moor Alloy Steelworks Ltd.	29 „
Low Moor Fine Steels Ltd.	29 „
Lycoming (U.S.A.)	111 „
M.L. Aviation Co., Ltd.	91 „
Marconi's Wireless Telegraph Co., Ltd.	24 „
Marston Excelsior Ltd.	81 „
Martin, The Glenn L. Company (U.S.A.)	40 „
Martin-Baker Aircraft Co., Ltd.	18 „



WESTLAND HELICOPTERS

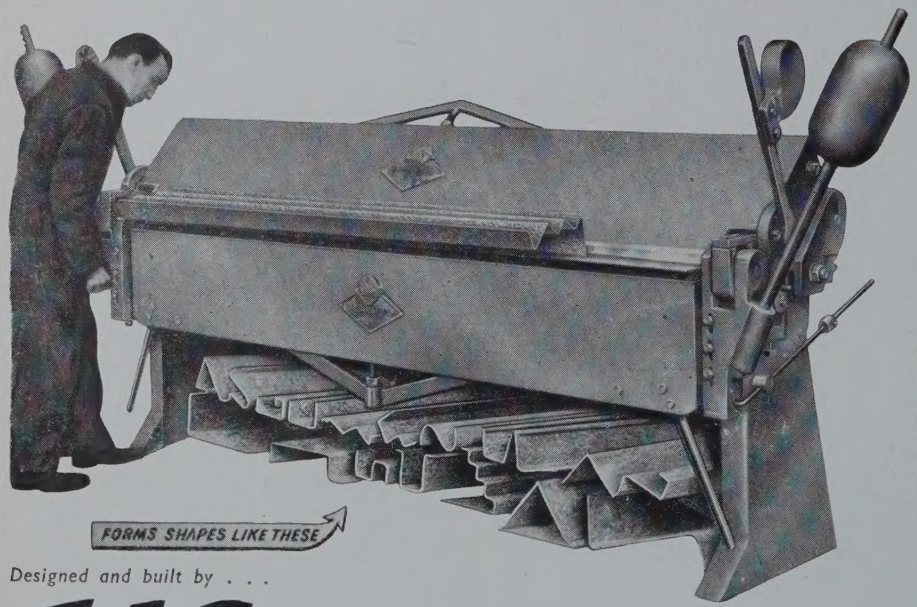
IN SERVICE FROM THE ARCTIC TO THE TROPICS

ALPHABETICAL LIST OF ADVERTISERS—continued.

	PAGE
Mills Equipment Co., Ltd., The	85 adv.
Mollart Engineering Co., Ltd., The	86 „
M.S.S. Recording	89 „
Napier, D., & Son Ltd.	*Inside front cover*
Newton Bros. (Derby) Ltd.	75 adv.
Normalair Ltd.	20 „
Northern Aluminium Co., Ltd.	119 „
Omnipol Ltd.	32 „
Orenda Engines Ltd. (Canada)	68 „
Percival Aircraft Ltd.	54 „
Piper Aircraft Corporation (U.S.A.)	70 „
Plessey Co., Ltd., The	101 „
Pye Ltd.	103 „
Redifon, Ltd.	118 „
Republic Aviation Corporation (U.S.A.)	72 „
Roe, A. V., Canada, Ltd. (Canada)	120 „
Rolls-Royce Ltd.	97 „
S.F.E.C.M.A.S. (France)	74 „
Salter, Geo. & Co., Ltd.	92 „
Sampson Low, Marston & Co., Ltd.	88 „
Short Bros. & Harland, Ltd.	52 „
Siebe, Gorman & Co., Ltd.	91 „
Société Nationale de Constructions Aéronautiques du Nord (France)	74 adv.
Solar Aircraft Company	47 „
Sperry Gyroscope Co., Ltd., The	50 „
Standard Telephones & Cables Ltd.	77 „
Sud Aviation	76 „
Svenska Aeroplan A.B. (Saab Aircraft Co.) (Sweden)	16 „
Titanine Ltd.	46 „
Thermionic Products Ltd.	37 „
Thompson Brothers (Bilston) Ltd.	48 „
United Steel Companies Ltd., The	117 „
Van Der Horst Corporation of America (U.S.A.)	33 „
Varley All-Dry Batteries Ltd.	41 „
Vertol Aircraft Corporation	4 „
Vickers-Armstrongs Ltd.	93 & 94 „
Vinten, W., Ltd.	90 „
Vokes Ltd.	79 „
Vosper Ltd.	44 „
Western Manufacturing (Reading) Ltd.	81 „
Westland Aircraft Ltd.	8 „
Wiggin, Henry & Co., Ltd.	107 „
Williamson Manufacturing Co., Ltd.	87 „
Yorkshire Engineering Supplies Ltd.	86 „

Intricate bends made easy

with the BESCO ALL-STEEL UNIVERSAL FOLDING MACHINE MARK II



For hand operation. Fabricated steel plate construction. Counter-balanced folding beam. Adjustment for round and sharp bends. Adjustable folding axis. Quick clamping through eccentric levers. Top beam rises 2½ in. Beams are mounted on replaceable bearings. Narrow return bends can be made in light material. Adjustable angle stop for repetition bending. With auxiliary blade, capacity given is for a 1 in. wide flange in mild steel. Made in various sizes and capacities covering mild steel sheets from 48 in. to 120 in. wide and 16 to 12 s.w.g. mild steel or equal. ALL STEEL CONSTRUCTION—Unbreakable.

Designed and built by . . .

F. J. Edwards Ltd

talking of machinery — BESCO MACHINERY — *think of Edwards*

MAKERS OF BESCO SHEET METAL WORKING MACHINERY, ACCESSORIES AND PRESSES

EDWARDS HOUSE, 359-361 EUSTON ROAD, LONDON, N.W.1 Telephone: EUSton 4631 (7 lines) 3771 (4 lines) Telegrams: Bescotools Northwest London
LANSDOWNE HOUSE, 41 WATER STREET, BIRMINGHAM, 3 Telephone: CENtral 7606-8 Telegrams: Bescotools Birmingham 3



Prototype of the Boeing 707, America's first jetliner, which in March 1957, flew across the United States in 3 hours, 48 minutes, averaging 612 mph. More than 140 707s have been ordered by leading world airlines for delivery beginning in late 1958. The 707 is backed by Boeing's 20 years of multi-engine, pressurized aircraft experience.



Pod-mounting of the 707's engines is an important safety feature that also makes engines readily accessible for maintenance or change. The 707 incorporates unique design advantages born of the experience Boeing gained in building more than 1400 long-range multi-jet B-47s and B-52s.



The 707 has completed more than 700 hours of flight testing, and has operated effortlessly in the routine traffic patterns of airports in Seattle, Los Angeles, Chicago, Washington, D.C., Baltimore and other cities.

BOEING

10 adv.

CLASSIFIED LIST OF ADVERTISERS—*continued.*

ACCESSORIES PAGE
Dunlop Rubber Co., Ltd. .. 104 adv.
Fairchild Engine & Airplane Corporation .. .. .. 30 ,,
Integral Ltd. .. .. .. 85 ,,
Iso-Speedic Co., Ltd., The .. 5 ,,
Marston Excelsior Ltd. .. 81 ,,
Mills Equipment Co., Ltd., The 85 ,,
Plessey Co., Ltd., The .. 101 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,
Vickers-Armstrongs Ltd. 93 & 94 ,,

ACCUMULATORS, HYDRAULIC
Automotive Products Co., Ltd. 28 ,,
Dunlop Rubber Co., Ltd. .. 104 ,,
Fairey Aviation Co., Ltd., The 62 ,,
H.M.L. (Engineering) Ltd. .. 43 ,,

ACCUMULATORS, HYDRAULIC, AIR OR WEIGHT LOADED
Automotive Products Co., Ltd. 28 ,,
H.M.L. (Engineering) Ltd. .. 43 ,,

ACTUATORS, ELECTRIC
British Thomson-Houston Co., Ltd., The .. .. .. 61 ,,
English Electric Co., Ltd., The 22 & 90 ,,
Plessey Co., Ltd., The .. 101 ,,
Western Manufacturing (Reading) Ltd. .. .. 81 ,,

ADHESIVES
Aero Research Ltd. (Redux) 112 ,,
Cellon Ltd. .. .. .. 57 ,,
Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The .. 58 ,,
Société Nationale de Constructions Aéronautiques du Sud-Ouest .. .. 74 ,,

AERIAL SURVEY INSTRUMENTS
Barr & Stroud Ltd. *Inside Back Cover*

AERO AUXILIARY EQUIPMENT
A.B.C. Motors Ltd. .. .. 88 adv.
Brown, S. G., Ltd. .. .. 88 ,,
Dunlop Rubber Co., Ltd. .. 104 ,,

AERO-ENGINE TEST PLANT
Curran John, Ltd. .. .. 83 ,,
Heenan & Froud Ltd. .. 12 ,,
M.S.S. Recordings Co. Ltd. .. 89 ,,
Roe, A. V. Canada, Ltd. .. 120 ,,
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 ,,

AERO-ENGINES
Alvis Ltd. .. .. .. 113 ,,
Avco-Lycoming .. .. 111 ,,
Blackburn & General Aircraft Ltd. .. .. 66 ,,
Bristol Aeroplane Co., Ltd., The 95 & 96 ,,
de Havilland Enterprise, The 2, 25 & 108 ,,
Fiat S.p.A. .. .. .. 38 ,,
Hawker Siddeley Group Ltd. 45 ,,
Hispano Suiza .. .. .. 36 ,,
Napier, D., & Son, Ltd. *Inside front cover*
Roe, A. V. Canada, Ltd. .. 120 adv.
Rolls-Royce Ltd. .. .. 97 ,,

AERONAUTICAL ENGINEERS AND CONSULTANTS
A.B.C. Motors Ltd. .. .. 88 ,,
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Short Bros. & Harland Ltd. .. 52 ,,
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 ,,

AIR CAMERAS
Vinten, W. Ltd. .. .. 90 ,,
Williamson Manufacturing Co., Ltd. .. .. 87 ,,

AIR COMPRESSORS PAGE
Avco-Lycoming .. .. 111 adv.
Dunlop Rubber Co., Ltd. .. 104 ,,
Siebe Gorman & Co., Ltd. .. 91 ,,

AIR COMPRESSORS FOR ENGINE STARTING
Avco-Lycoming .. .. 111 ,,
Siebe Gorman & Co., Ltd. .. 91 ,,
Solar Aircraft Company 47 ,,

AIR CONDITIONING
Dragonair Ltd. .. .. 86 ,,
M.L. Aviation Co., Ltd. .. 91 ,,

AIR CONTROL EQUIPMENT FOR CABINS
Kollsman Instrument Corporation (U.S.A.) .. .. 100 ,,
Marston Excelsior Ltd. .. 81 ,,
Normalair Ltd. .. .. .. 20 ,,
Vokes Ltd. .. .. .. 79 ,,

AIR FILTERS
Fiat S.p.A. .. .. .. 38 ,,

AGRICULTURAL AIRCRAFT (DUSTERS AND SPRAYERS)
Bell Aircraft Corporation .. 82 ,,
Piper Aircraft Corporation .. 70 ,,

AIRCRAFT—AMBULANCE
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Bell Aircraft Corporation .. 82 ,,
Blackburn & General Aircraft Ltd. .. .. 66 ,,
Bristol Aeroplane Co., Ltd., The 95 & 96 ,,
de Havilland Enterprise, The 2, 25 & 108 ,,
Omnipol Ltd. (Czechoslovakia) 32 ,,
Percival Aircraft Ltd. .. 54 ,,
Short Bros. & Harland Ltd. .. 52 ,,
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 ,,
Vickers-Armstrongs Ltd. 93 & 94 ,,
Westland Aircraft Ltd. .. 8 ,,

AIRCRAFT—AMPHIBIAN
Bell Aircraft Corporation .. 82 ,,
Folland Aircraft Ltd. .. .. 98 ,,
Martin, The Glenn L. Co. 40 ,,
Short Bros. & Harland Ltd. .. 52 ,,
Vickers-Armstrongs, Ltd. 93 & 94 ,,

AIRCRAFT—COMMERCIAL
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Avions, Hurel-Dubois .. .. 84 ,,
Bell Aircraft Corporation .. 82 ,,
Blackburn & General Aircraft Ltd. .. .. 66 ,,
Boeing Airplane Company .. 10 ,,
Bristol Aeroplane Co., Ltd., The 95 & 96 ,,
Convair (Division of General Dynamics Corporation) .. 106 ,,
de Havilland Enterprise, The 2, 25 & 108 ,,
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 ,,
Folland Aircraft Ltd. .. 98 ,,
Handley Page Ltd. .. .. 99 ,,
Martin, The Glenn L. Co. 40 ,,
Percival Aircraft Ltd. .. 54 ,,
Piper Aircraft Corporation .. 70 ,,
Short Bros. & Harland Ltd. 52 ,,
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 ,,
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 ,,
Vickers Armstrongs Ltd. 93 & 94 ,,
Westland Aircraft Ltd... .. 8 ,,

AIRCRAFT—EXPERIMENTAL
Société Nationale de Constructions Aéronautiques du Nord 74 ,,
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 ,,

AIRCRAFT—FLYING BOAT PAGE
Convair (A Division of General Dynamics Corporation) .. 106 adv.
Folland Aircraft Ltd. .. .. 98 ,,
Martin, The Glenn L. Co. 40 ,,
Short Bros. & Harland Ltd. 52 ,,

AIRCRAFT—GLIDER
Omnipol Ltd. (Czechoslovakia) 32 ,,
Short Bros. & Harland Ltd. .. 52 ,,

AIRCRAFT—JET PROPELLED
Avro Aircraft Ltd. .. .. 120 ,,
Bell Aircraft Corporation .. 82 ,,
Boeing Airplane Company .. 10 ,,
Boulton Paul Aircraft Ltd. .. 64 ,,
Bristol Aeroplane Co., Ltd., The 95 & 96 ,,
Convair (A Division of General Dynamics Corporation) .. 106 ,,
de Havilland Enterprise, The 2, 25 & 108 ,,
Fiat S.p.A. .. .. .. 38 ,,
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 ,,
Folland Aircraft Ltd. .. 98 ,,
Handley Page Ltd. .. .. 99 ,,
Hawker Siddeley Group Ltd. .. 115 ,,
Martin, The Glenn L. Co. .. 40 ,,
Percival Aircraft Ltd. .. 54 ,,
Republic Aviation Corp. (U.S.A.) 72 ,,
Roe, A. V. Canada, Ltd. .. 120 ,,
Short Bros. & Harland Ltd. .. 52 ,,
Société Nationale de Constructions Aéronautiques du Nord 74 ,,
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 ,,
Vickers-Armstrongs Ltd. 93 & 94 ,,

AIRCRAFT—LANDPLANE
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Blackburn & General Aircraft Ltd. .. .. .. 66 ,,
Boeing Airplane Company .. 10 ,,
Boulton Paul Aircraft Ltd. .. 64 ,,
Bristol Aeroplane Co., Ltd., The 95 & 96 ,,
Convair (A Division of General Dynamics Corporation) .. 106 ,,
de Havilland Enterprise, The 2, 25 & 108 ,,
Fairchild Engine & Airplane Corporation .. .. .. 30 ,,
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 ,,
Folland Aircraft Ltd. .. .. 98 ,,
Handley Page Ltd. .. .. 99 ,,
Hawker Siddeley Group Ltd. .. 115 ,,
Martin, The Glenn L. Co. .. 40 ,,
Omnipol Ltd. (Czechoslovakia) 32 ,,
Percival Aircraft Ltd. .. 54 ,,
Piper Aircraft Corporation .. 70 ,,
Short Bros. & Harland Ltd. .. 52 ,,
Société Nationale de Constructions Aéronautiques du Nord 74 ,,
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. .. 16 ,,
Vickers-Armstrongs Ltd. 93 & 94 ,,
Westland Aircraft Ltd. .. 8 ,,

AIRCRAFT—MILITARY
Avro Aircraft Ltd. .. .. 120 ,,
Bell Aircraft Corporation .. 82 ,,
Blackburn & General Aircraft Ltd. .. .. .. 66 ,,
Boeing Airplane Company .. 10 ,,
Boulton Paul Aircraft Ltd. .. 64 ,,
Bristol Aeroplane Co., Ltd., The 95 & 96 ,,
Convair (A Division of General Dynamics Corporation) .. 106 ,,
de Havilland Enterprise, The 2, 25 & 108 ,,
English Electric Co., Ltd., The 22 & 90 ,,
Fiat S.p.A. .. .. .. 38 ,,
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 ,,
Folland Aircraft Ltd. .. .. 98 ,,
Handley Page Ltd. .. .. 99 ,,



HEENAN & FROUDE LTD · WORCESTER · ENGLAND

AIRCRAFT MILITARY—*cont.*

Hawker Siddeley Group Ltd. .. 115 adv.
Martin, The Glenn L. Co. 40 „
Percival Aircraft Ltd. .. 54 „
Republic Aviation Corp. (U.S.A.) 72 „
Roe, A. V. Canada, Ltd. .. 120 „
Short Bros. & Harland Ltd. .. 52 „
Société Nationale de Constructions Aéronautiques du Nord 74 „
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 „
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „
Vickers-Armstrongs Ltd. 93 & 94 „
Westland Aircraft Ltd... .. 8 „

AIRCRAFT—NAVAL

Blackburn & General Aircraft Ltd. .. .. 66 „
Boulton Paul Aircraft Ltd. .. 64 „
Bristol Aeroplane Co., Ltd., The 95 & 96 „
Convair (A Division of General Dynamics Corporation) .. 106 „
de Havilland Enterprise, The 2, 25 & 108 „
Fairey Aviation Co., Ltd., The 62 „
Folland Aircraft Ltd. .. 98 „
Hawker Siddeley Group Ltd. .. 115 „
Martin, The Glenn L. Co. .. 40 „
Percival Aircraft Ltd. .. 54 „
Short Bros. & Harland Ltd. .. 52 „
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 „
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „
Vickers-Armstrongs Ltd. 93 & 94 „
Westland Aircraft Ltd. .. 8 „

AIRCRAFT—PRIVATE

Aviation Traders (Engineering) Ltd. .. .. 34 „
Bell Aircraft Corporation .. 82 „
Blackburn & General Aircraft Ltd. .. .. 66 „
de Havilland Enterprise, The 2, 25 & 108 „
Folland Aircraft Ltd. .. .. 98 „
Omnipol Ltd. (Czechoslovakia) 32 „
Percival Aircraft Ltd. .. 54 „
Short Bros. & Harland Ltd. .. 52 „
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 „
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „
Vickers-Armstrongs Ltd. 93 & 94 „
Westland Aircraft Ltd. .. 8 „

AIRCRAFT—RADIO CONTROLLED, GUIDED

M.L. Aviation Co., Ltd. .. 91 adv.

AIRCRAFT, ROCKET PROPELLED

Bell Aircraft Corporation .. 82 adv.

AIRCRAFT, VERTICAL TAKE-OFF AND LANDING

Bell Aircraft Corporation .. 82 adv.
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „

AIRCRAFT—SEAPLANE

Convair (A Division of General Dynamics Corporation) .. 106 „
de Havilland Enterprise, The 2, 25 & 108 „
Folland Aircraft Ltd. .. .. 98 „
Martin, The Glenn L. Co. .. 40 „
Piper Aircraft Corporation .. 70 „
Short Bros. & Harland Ltd. .. 52 „
Société Nationale de Constructions Aéronautiques du Nord 74 „
Vickers-Armstrongs Ltd. 93 & 94 „

AIRCRAFT—SUPERSONIC

Bell Aircraft Corporation .. 82 „

AIRCRAFT—TRAINING

Aviation Traders (Engineering) Ltd. .. .. 34 adv.
Boulton Paul Aircraft Ltd. .. 64 „
Convair (A Division of General Dynamics Corporation) .. 106 „
de Havilland Enterprise, The 2, 25 & 108 „
Fairey Aviation Co., Ltd., The 62 „
Fiat S.p.A. .. .. .. 38 „
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 „
Folland Aircraft Ltd. .. .. 98 „
Hindustan Aircraft Ltd. .. 78 „
Martin, The Glenn L. Co. .. 40 „
Omnipol Ltd. (Czechoslovakia) 32 „
Percival Aircraft Ltd. .. 54 „
Société Nationale de Constructions Aéronautiques du Nord 74 „
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 „
Vickers-Armstrongs Ltd. 93 & 94 „
Westland Aircraft Ltd. .. 8 „

AIRCRAFT—TRANSPORT

Blackburn & General Aircraft Ltd. .. .. 66 „
Boeing Airplane Company .. 10 „
Bristol Aeroplane Co., Ltd., The 95 & 96 „
Convair (A Division of General Dynamics Corporation) .. 106 „
de Havilland Enterprise, The 2, 25 & 108 „
Fairchild Engine & Airplane Corporation .. .. .. 30 „
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 „
Folland Aircraft Ltd. .. .. 98 „
Handley Page Ltd. .. .. 99 „
Martin, The Glenn L. Co. .. 40 „
Omnipol Ltd. (Czechoslovakia) 32 „
Percival Aircraft Ltd. .. 54 „
Roe, A. V. Canada Ltd. .. 120 „
Short Bros. & Harland Ltd. .. 52 „
Svenska Aeroplan A.B. (Saab Aircraft Co.) .. .. 16 „
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „
Vickers-Armstrongs Ltd. 93 & 94 „
Westland Aircraft Ltd... .. 8 „

AIRCRAFT HANGARS

Bellman Hangars Ltd... .. 109 „

AIRCRAFT PISTON ENGINE CYLINDERS—PORUS-KROME PLATED

Fiat S.p.A. .. .. .. 38 „
Van Der Horst Corporation of America .. .. 33 „

AIRCRAFT PROPELLERS

de Havilland Enterprise, The 2, 25 & 108 „
Fairey Aviation Co., Ltd., The 62 „
Fiat S.p.A. .. .. .. 38 „
Omnipol Ltd. (Czechoslovakia) 32 „

AIRFIELD LIGHTING, REMOTE CONTROL SYSTEMS

Standard Telephones & Cables Ltd. .. .. 77 „

AIRPORT MAINTENANCE EQUIPMENT

M.L. Aviation Co., Ltd. .. 91 adv.

AIR TRANSPORT CONTRACTING

Aviation Traders (Engineering) Ltd. .. .. 34 „

ALTERNATORS

British Thomson-Houston Co., Ltd., The .. .. .. 61 „
English Electric Co., Ltd., The 22 & 90 „
Newton Brothers (Derby) Ltd. 75 „
Plessey Co., Ltd., The .. 101 „

ALUMINIUM & ALUMINIUM ALLOYS

British Insulated Callendar's Cables Ltd. .. .. .. 105 adv.
Hawker Siddeley Group Ltd. .. 115 „
High Duty Alloys Ltd. .. 102 „
Northern Aluminium Co., Ltd. 119 „

ALUMINIUM HANGAR DOORS

Esavian Ltd. .. .. .. 92 „

AMERICAN SPARES

Anglo American Aviation Company .. .. .. 87 „
Fiat S.p.A. .. .. .. 38 „
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „

ANTI-VIBRATION MOUNTINGS

Dunlop Rubber Co., Ltd. .. 104 „
Fiat S.p.A. .. .. .. 38 „

ARMAMENTS FOR AIRCRAFT

Boulton Paul Aircraft Ltd. 64 „
Bristol Aeroplane Co., Ltd., The 95 & 96 „
Dunlop Rubber Co., Ltd. .. 104 „
Hispano Suiza .. .. .. 36 „
M.L. Aviation Co., Ltd. .. 91 „
Martin-Baker Aircraft Co., Ltd. 18 „
Martin, The Glenn L. Co. .. 40 „

ASSEMBLY AND DRILLING JIGS

Aviation Traders (Engineering) Ltd. .. .. 34 adv.
Cornercroft Ltd. .. .. 6 „
Fiat S.p.A. .. .. .. 38 „

ASSISTED—TAKE-OFF

(Liquid- and solid-propellant rockets for assisted-takeoff, in-flight thrust augmentation, and missile applications)

Fiat S.p.A. .. .. .. 38 „

AUTOMATIC TELEPHONY EQUIPMENT

Martin, The Glenn L. Co. .. 40 „
Pye Ltd. .. .. .. 103 „

AUTOMATIC VOLTAGE AND CURRENT REGULATORS

Ferranti Ltd. .. .. .. 67 „
Jack & Heintz .. .. .. 53 „
Newton Brothers (Derby) Ltd. 75 „

AUXILIARY POWER UNITS AND GAS GENERATORS

Jack & Heintz .. .. .. 53 „
Solar Aircraft Company 47 „

AVIATION GASOLINE

B.P. Aviation Service .. .. 55 „
Esso Aviation Products .. 116 „

AVIATION LUBRICATING OIL AND SPECIAL PRODUCTS

B.P. Aviation Service .. .. 55 „
Esso Aviation Products .. 116 „

AVIATION TURBOFUEL

B.P. Aviation Service .. .. 55 „
Esso Aviation Products .. 116 „

BALL JOINTS

Amal Ltd. .. .. .. 27 „
Solar Aircraft Company 47 „

BALLOONS

Elliot Equipment Ltd. .. 45 „

BANNER TARGETS

Elliot Equipment Ltd. .. 45 „

BAR, LIGHT METAL

Fiat S.p.A. .. .. .. 38 „
High Duty Alloys, Ltd. .. 102 „

BARS, PHOSPHOR BRONZE

Fiat S.p.A. .. .. .. 38 „
Yorkshire Engineering Supplies Ltd. .. .. 86 „

Every British aircraft flying today (and for the last twenty years) has been constructed with the help of Desoutter power tools



DESOUTTER BROS., LIMITED, THE HYDE, HENDON, N.W.9 TELEPHONE: COLINDALE 6346 (5 LINES) TELEGRAMS: DESPNUCO, HYDE, LONDON
CRC 32M

BARS—STAINLESS AND HEAT-RESISTING STEEL

	PAGE
Fiat S.p.A.	38 adv.
Fox, Samuel & Co., Ltd.	117 „
Low Moor Alloy Steelworks Ltd.	29 „

BEARINGS, BALL & PARALLEL

Fiat S.p.A.	38 „

BEARINGS, BRONZE

Fiat S.p.A.	38 „
Yorkshire Engineering Supplies Ltd.	86 „

BEARINGS, ROLLER, SINGLE AND DOUBLE ROW SELF ALIGNING

Fiat S.p.A.	38 adv.
Geo. Salter & Co. Ltd.	92 „

BELLOWS

Solar Aircraft Company	47 „

BELTS, SAFETY

Mills Equipment Co., Ltd., The	85 „
Siebe, Gorman & Co., Ltd.	91 „

BINOCULARS

Barr & Stroud Ltd.	*Inside back cover*
Dobbie McInnes Ltd.	85 adv.

BLADES, GAS TURBINE, FORGED

Garringtons Ltd.	60 adv.
High Duty Alloys Ltd.	102 „
Jessop, William & Sons, Ltd.	110 „

BLADES, GAS TURBINE, PRECISION CAST

Fiat S.p.A.	38 adv.
Jessop, William & Sons, Ltd.	110 „

BOATS—INFLATABLE

Elliot Equipment Ltd.	45 „

BOATS, POWER AND SPEED

Vosper Ltd.	44 „

BOMBSIGHTS

Sperry Gyroscope Co., Ltd., The	50 „
Svenska Aeroplan A.B. (Saab Aircraft Co.)	16 „

BRAKE LININGS

Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The	58 „

BRAKES FOR AIRCRAFT

Dunlop Rubber Co., Ltd.	104 „
Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The	58 „

CABIN COOLING (TROPICAL AIRFIELD EQUIPMENT)

M.L. Aviation Co., Ltd.	91 adv.

CABIN HEATING

Dragonair Ltd.	86 „
Marston Excelsior Ltd.	81 „
Normalair Ltd.	20 „

CABIN PRESSURISING TEST EQUIPMENT

M.L. Aviation Co., Ltd.	91 „

CABLES, AIRCRAFT

British Insulated Callender's Cables Ltd.	105 „
Fiat S.p.A.	38 „
Plessey Co., Ltd., The	101 „
Standard Telephones and Cables Ltd.	77 „

CABLES, IGNITION

British Insulated Callender's Cables Ltd.	105 „
Fiat S.p.A.	38 „
Plessey Co., Ltd., The	101 „

CANVAS

Mills Equipment Co., Ltd., The	85 „

CARBURETTORS

	PAGE
Fiat S.p.A.	38 adv.
Hobson, H. M., Ltd.	71 „

CASTINGS, PHOSPHOR BRONZE AND GUN METAL

Yorkshire Engineering Supplies Ltd.	86 adv.

CASTINGS, SAND, GRAVITY DIE AND PRESSURE DIE, LIGHT METALS

Fiat S.p.A.	38 adv.
Hawker Siddeley Group Ltd.	115 „
High Duty Alloys Ltd.	102 „
Northern Aluminium Co., Ltd.	119 „
Geo. Salter & Co., Ltd.	92 „

CASTINGS—STAINLESS AND HEAT-RESISTING STEEL, CENTRIFUGAL, STATIC AND PRECISION

Fiat S.p.A.	38 adv.

CASTINGS, STEEL

Brown Foundries Co., The David	39 „
Fiat S.p.A.	38 „
Jessop, William & Sons, Ltd.	110 „

CHROME HARDENING

Van Der Horst Corporation of America	33 „

CINE COMBAT CAMERAS

Vinten, W. Ltd.	90 „

CIRCLIPS

Geo. Salter & Co., Ltd.	92 „

CLIPS AND FASTENERS, COWLING

Amal Ltd.	27 adv.
Fairey Aviation Co., Ltd., The	62 „

CLIPS FOR LEADS, PIPES, Etc.

Dunlop Rubber Co., Ltd.	104 „
Geo. Salter & Co., Ltd.	92 „

COMMUNICATION EQUIPMENT

Brush Crystal Co., Ltd.	37 „
Thermionic Products Ltd.	37 „

COMPASSES

Brown, S.G. Ltd.	88 „
Dobbie McInnes Ltd.	85 „
Kollsman Instrument Corporation (U.S.A.)	100 „
Omnipol Ltd. (Czechoslovakia)	32 „

COMPONENTS

Avco-Lycoming	111 „
Aviation Traders (Engineering) Ltd.	34 „
Brown, S. G. Ltd.	88 „
Cornercroft Ltd.	6 „
Dunlop Rubber Co., Ltd.	104 „
Fairchild Engine & Airplane Corporation	30 „
Ferranti Ltd.	67 „
Iso-Speedic Co., Ltd., The	5 „
Jack & Heintz	53 „
Kollsman Instrument Corporation (U.S.A.)	100 „
Pye Ltd.	103 „
Solar Aircraft Company	47 „
Thompson Brothers (Bilston) Ltd.	48 „
Western Manufacturing (Reading) Ltd.	81 „

CONTROL EQUIPMENT FOR AIRCRAFT

Bell Aircraft Corporation	82 adv.
Boulton Paul Aircraft Ltd.	64 „
Brown S. G. Ltd.	88 „
Dunlop Rubber Co., Ltd.,	104 „
Fairey Aviation Co., Ltd., The	62 „
Hobson, H. M. Ltd.	71 „
Iso-Speedic Co., Ltd., The	5 „
Kollsman Instrument Corporation (U.S.A.)	100 „
M.L. Aviation Co., Ltd.	91 „
Omnipol Ltd. (Czechoslovakia)	32 „
Solar Aircraft Company	47 „

CONTROL JOINTS, BALL & ROLLER

	PAGE
Amal Ltd.	27 adv.

CONTROLS, COCKPIT

Dunlop Rubber Co., Ltd.	104 „
Hobson, H. M., Ltd.	71 „

COOLERS, OIL

Marston Excelsior Ltd.	81 „

COOLERS, WATER

Heenan & Froude Ltd.	12 „
Marston Excelsior Ltd.	81 „

COVERS, AIRCRAFT WEATHER

Elliot Equipment Ltd.	45 „

CRANKSHAFTS

Jessop, William & Sons, Ltd.	110 „

CRIMPING TOOLS FOR SOLDERLESS JOINTS

Plessey Co., Ltd., The	101 „

CYLINDERS—PISTON ENGINE—PORUS-KROME PLATED

Van Der Horst Corporation of America	33 „

CYLINDERS—PNEUMATIC—CHROMIUM PLATED

Van Der Horst Corporation of America	33 „

DE-ICING EQUIPMENT

Dragonair Ltd.	86 „
Dunlop Rubber Co., Ltd.	104 „
Vertol Aircraft Corporation (U.S.A.)	4 „
Western Manufacturing (Reading) Ltd.	81 „

DINGHIES AND RAFTS

Siebe, Gorman & Co., Ltd.	91 „

DISCS, GAS TURBINE, FORGED

Fiat S.p.A.	38 „
Jessop, William & Sons, Ltd.	110 „

DISCS, GAS TURBINE, DROP STAMPED

Fiat S.p.A.	38 „
Jessop, William & Sons, Ltd.	110 „

DOPES

Cellon Ltd.	57 „

DRILLING MACHINES

Edwards, F. J., Ltd.	9 „
Fiat S.p.A.	38 „

DRILLS, PORTABLE, PNEUMATIC AND ELECTRIC

Desoutter Brothers, Ltd.	14 adv.

DUCTING—PNEUMATIC

Solar Aircraft Company	47 „

DYNAMIC BALANCING MACHINES

Sperry Gyroscope Co., Ltd., The	50 adv.

DYNAMOMETERS, ELECTRICAL EDDY-CURRENT

Heenan & Froude, Ltd.	12 „

DYNAMOMETERS, HYDRAULIC AND ELECTRIC

Heenan & Froude, Ltd.	12 adv.

ECONOMISERS

Elliot Equipment Ltd.	45 „

EJECTION SEATS

Martin-Baker Aircraft Co., Ltd.	18 „

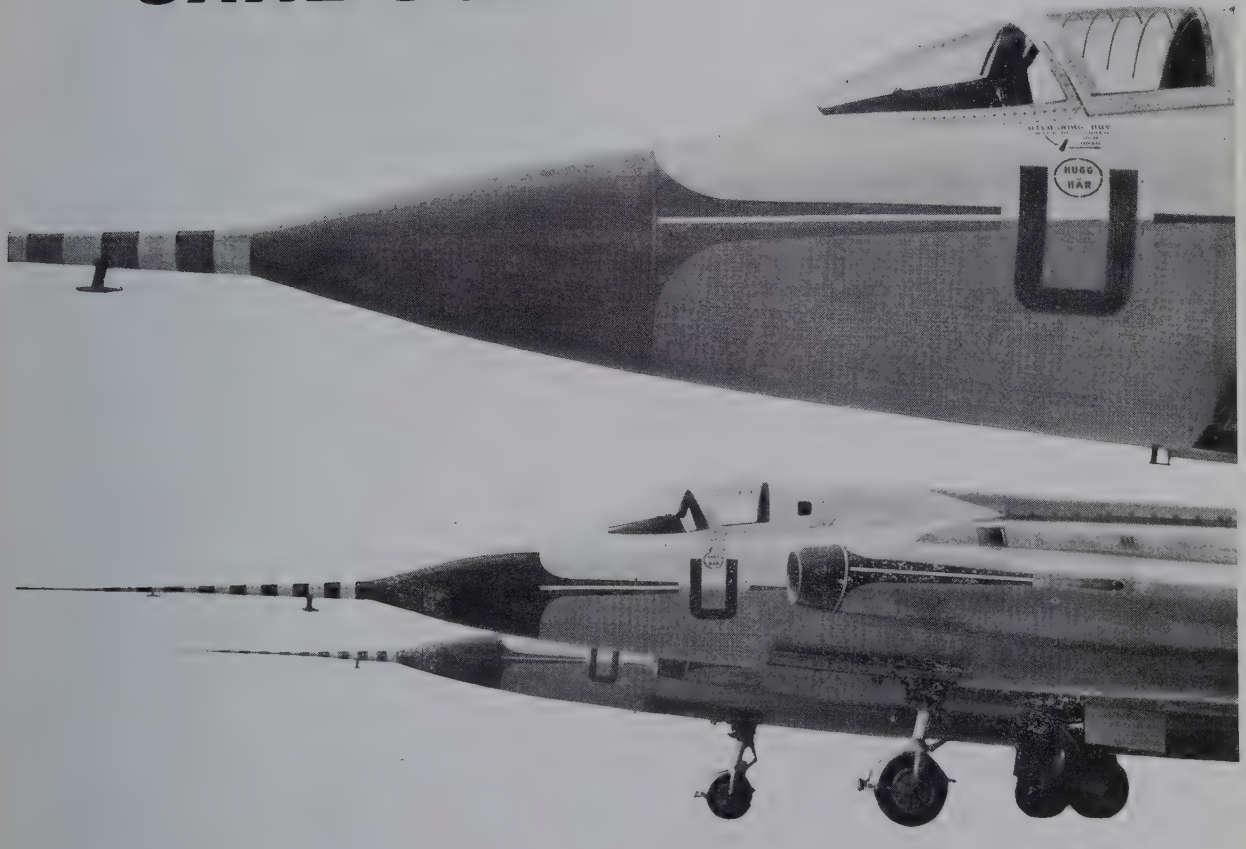


SAAB

The Saab-35 "Draken" supersonic all-weather jet fighter is one of the most advanced aircraft in quantity production. It has a high supersonic top speed, a phenomenal rate of climb and a very high operating altitude. Yet it can operate from relatively small airfields. The Saab-35 is powered by a Rolls-Royce Avon turbojet with afterburner, built in Sweden by Svenska Flygmotor. Its armament consists of cannon, rockets and guided missiles.

first supersonic jet fighter for the Swedish Air Force

SAAB J 35



SVENSKA AEROPLAN AKTIEBOLAGET *(SAAB AIRCRAFT COMPANY)* · LINKÖPING · SWEDEN

ELECTRIC AUXILIARIES

	PAGE
British Thomson-Houston Co., Ltd., The	61 adv.
Brown, S. G. Ltd.	88 ,,
Convair (A Division of General Dynamics Corporation)	106 ,,
Jack & Heintz	53 ,,
Plessey Co., Ltd., The	101 ,,
Western Manufacturing (Reading) Ltd.	81 ,,

ELECTRICAL EQUIPMENT

British Insulated Callender's Cables Ltd.	105 ,,
British Thomson-Houston Co., Ltd., The	61 ,,
Dunlop Rubber Co., Ltd.	104 ,,
Ferranti Ltd.	67 ,,
Fiat S.p.A.	38 ,,
Jack & Heintz	53 ,,
M.L. Aviation Co., Ltd.	91 ,,
Newton Bros. (Derby) Ltd.	75 ,,
Plessey Co., Ltd., The	101 ,,
Pye Ltd.	103 ,,
Western Manufacturing (Reading) Ltd.	81 ,,

ELECTRICAL OVERHAUL

Western Manufacturing (Reading) Ltd.	81 ,,

ELECTRICAL PLANT

British Thomson-Houston Co., Ltd., The	61 ,,
Newton Bros. (Derby) Ltd.	75 ,,

ELECTRICAL PLUGS AND SOCKETS (WATERPROOF)

M.L. Aviation Co., Ltd.	91 adv.

ELECTRONIC EQUIPMENT

Avco-Lycoming	111 ,,
Bell Aircraft Corporation	82 ,,
Boulton Paul Aircraft Ltd.	64 ,,
Brush Crystal Co., Ltd.	37 ,,
Ferranti Ltd.	67 ,,
Fiat S.p.A.	38 ,,
M.L. Aviation Co., Ltd.	91 ,,
Martin, The Glenn L. Co.	40 ,,
M.S.S. Recordings Co. Ltd.	89 ,,
Pye Ltd.	103 ,,
Thermionic Products Ltd.	37 ,,

ELECTRONICS AND GUIDANCE

Avco-Lycoming	111 ,,
Bell Aircraft Corporation	82 ,,
Brown, S. G. Ltd.	88 ,,
Ferranti Ltd.	67 ,,
Kollsman Instrument Corporation (U.S.A.)	100 ,,
M.S.S Recordings Co. Ltd.	89 ,,

ELECTROPLATING

Van Der Horst Corporation of America	33 ,,

ENGINES, AUXILIARY

A.B.C. Motors Ltd.	88 ,,
de Havilland Enterprise, The	2, 25 & 108 ,,
Avco-Lycoming	111 ,,
Solar Aircraft Company	47 ,,

ENGINE PARTS

Anglo American Aviation Company	87 ,,

ENGINE PARTS FABRICATION

Fiat S.p.A.	38 ,,
Solar Aircraft Company	47 ,,
Western Manufacturing (Reading) Ltd.	81 ,,

ENGINE SCREENING HARNESS

Plessey Co., Ltd., The	101 adv.

ENGINE STARTING EQUIPMENT

	PAGE
A.B.C. Motors Ltd.	88 adv.
British Thomson-Houston Co., Ltd., The	61 ,,
Jack & Heintz	53 ,,
Plessey Co., Ltd., The	101 ,,
Solar Aircraft Company	47 ,,
Standard Telephones and Cables Ltd.	77 ,,

ENGINE TESTING EQUIPMENT

Dobbie McInnes Ltd.	85 ,,
Heenan & Froude Ltd.	12 ,,
Hobson, H. M., Ltd.	71 ,,
Plessey Co., Ltd., The	101 ,,
Standard Telephones & Cables Ltd.	77 ,,

ENGINES—AIRCRAFT

Blackburn & General Aircraft Ltd.	66 ,,
Bristol Aeroplane Co., Ltd., The	95 & 96 ,,
Continental Motors Corporation	114 ,,
de Havilland Enterprise, The	2, 25 & 108 ,,
Fiat S.p.A.	38 ,,
Hawker Siddeley Group Ltd.	115 ,,
Hispano Suiza	36 ,,
Napier, D., & Son, Ltd.	*Inside front cover*
Omnipol Ltd. (Czechoslovakia)	32 ,,
Orenda Engines Ltd.	68 ,,

ENGINES, ROCKET

Bell Aircraft Corporation	82 ,,

ENGRAVING

Dragonair Ltd.	86 ,,
Vosper Ltd.	44 ,,

EQUIPMENT FOR AIRCRAFT

Aviation Traders (Engineering) Ltd.	34 ,,
Brown, S. G. Ltd.	88 ,,
Dunlop Rubber Co., Ltd.	104 ,,
Ferranti Ltd.	67 ,,
Kidde, Walter Co., Ltd., The	35 ,,
M.L. Aviation Co., Ltd.	91 ,,
Mills Equipment Co., Ltd., The	85 ,,
Normalair Ltd.	20 ,,
Plessey Co., Ltd., The	101 ,,
Siebe, Gorman & Co., Ltd.	91 ,,
Vickers-Armstrongs Ltd.	93 & 94 ,,

EQUIPMENT, FUEL INJECTION

Fiat S.p.A.	38 ,,
Hobson, H. M. Ltd.	71 ,,

EXPANSION JOINTS

Solar Aircraft Company	47 ,,

EXPERIMENTAL ASSEMBLIES

Brown, S. G. Ltd.	88 ,,
Cornercroft Ltd.	6 ,,
Solar Aircraft Company	47 ,,

EXTRUSIONS, LIGHT METAL

Fiat S.p.A.	38 ,,
Hawker Siddeley Group Ltd.	115 ,,
High Duty Alloys Ltd.	102 ,,
Low Moor Fine Steels Ltd.	29 ,,
Northern Aluminium Co., Ltd.	119 ,,

EXTRUSIONS, STEEL

Low Moor Fine Steels Ltd.	29 ,,

FAIRINGS

Burnley Aircraft Products Ltd.	65 ,,
Marston Excelsior Ltd.	81 ,,

FANS, COOLING AND VENTILATING

Dragonair Ltd.	86 adv.

FASTENERS

	PAGE
Geo. Salter & Co., Ltd.	92 adv.

FEATHERING DEVICE, AUTOMATIC, FOR PROPELLERS

Martin-Baker Aircraft Co., Ltd.	18 adv.

FILLING VALVES

Dunlop Rubber Co., Ltd.	104 ,,

FILTERS, AIR

Automotive Products Co., Ltd.	28 ,,
Dunlop Rubber Co., Ltd.	104 ,,
Fiat S.p.A.	38 ,,
Vokes Ltd.	79 ,,

FILTERS, FUEL AND OIL

A.B.C. Motors Ltd.	88 ,,
Amal Ltd.	27 ,,
Automotive Products Co., Ltd.	28 ,,
Fiat S.p.A.	38 ,,
Vokes Ltd.	79 ,,

FINISHED MACHINED PARTS IN PHOSPHOR BRONZE AND GUN METAL

Aviation Traders (Engineering) Ltd.	34 ,,
Cornercroft Ltd.	6 ,,
Fiat S.p.A.	38 ,,
Yorkshire Engineering Supplies Ltd.	86

FINISHES FOR AIRCRAFT

Cellon Ltd.	57 ,,
Titanine Ltd.	46 ,,

FIRE EXTINGUISHERS

Kidde, Walter Co. Ltd., The	35 ,,
Siebe, Gorman & Co., Ltd.	91 ,,

FIRE FIGHTING VEHICLES

Fiat S.p.A.	38 ,,
Kidde, Walter Co., Ltd., The	35 ,,
Vertol Aircraft Corporation (U.S.A.)	4 ,,

FLAME TRAPS

Amal Ltd.	27 ,,

FLEXIBLE FUEL TANKS

Marston Excelsior Ltd.	81 ,,

FLIGHT SIMULATORS

Air Trainers Ltd.	89 ,,
Redifon Ltd.	118 ,,

FLOTATION GEAR

Elliot Equipment Ltd.	45 ,,
Kidde, Walter Co., Ltd., The	35 ,,
Westland Aircraft Ltd.	8 ,,

FLYING CLOTHING

G.Q. Parachute Co., Ltd., The	56 ,,
Siebe, Gorman & Co., Ltd.	91 ,,

FOAM DISCHARGING VEHICLES

Fiat S.p.A.	38 ,,

FOLDING AND BENDING MACHINES

Edwards, F. J., Ltd.	9 adv.

FORGINGS, DROP

Fiat S.p.A.	38 ,,
Garringtons Ltd.	60 ,,
Hawker Siddeley Group Ltd.	115 ,,
Jessop, William & Sons, Ltd.	110 ,,
Northern Aluminium Co., Ltd.	119 ,,
Solar Aircraft Company	47 ,,

FORGINGS, LIGHT METAL

Fiat S.p.A.	38 ,,
Garringtons Ltd.	60 ,,
Hawker Siddeley Group Ltd.	115 ,,
High Duty Alloys Ltd.	102 ,,
Northern Aluminium Co., Ltd.	119 ,,
Solar Aircraft Company	47 ,,



designers and manufacturers

of the world's finest

ejection seats

MARTIN-BAKER

Aircraft Company Limited

England & Canada

FORGINGS, STEEL

	PAGE
Fiat S.p.A.	38 adv.
Garringtons Ltd.	60 „
Jessop, William & Sons, Ltd.	110 „
Solar Aircraft Company	47 „

FUELS

BP Aviation Service	55 „
Esso Aviation Products	116 „
Fiat S.p.A.	38 „

FUEL COCKS

Vickers-Armstrongs Ltd.	93 & 94 „

FUEL HOSE ASSEMBLIES

Boorn, Thomas & Co., Ltd.	51 „

FUEL PUMPS

A.B.C. Motors Ltd.	88 „
Hobson, H. M. Ltd.	71 „
Plessey Co., Ltd., The	101 „
Siebe Gorman & Co., Ltd.	91 „

FUEL PUMPS (LIFT)

Amal Ltd.	27 „

FUELLING SERVICE

BP Aviation Service	55 „
Esso Aviation Products	116 „

FURNISHINGS FOR AIRCRAFT CABINS

Vickers-Armstrongs Ltd.	93 & 94 „

FUSE AND TERMINAL BLOCKS

Plessey Co., Ltd., The	101 „

GAS MASKS

Elliot Equipment Ltd.	45 „
Siebe, Gorman & Co., Ltd.	91 „

GAS TURBINES

Avco-Lycoming	111 „
Blackburn & General Aircraft Ltd.	66 „
Boeing Airplane Company	10 „
Bristol Aeroplane Co., Ltd., The	95 & 96 „
Continental Motors Corporation	114 „
de Havilland Enterprise, The	2, 25 & 108 „
Hawker Siddeley Group Ltd.	115 „
Napier, D., & Son Ltd.	*Inside front cover*
Orenda Engines Ltd.	68 adv.
Solar Aircraft Company	47 „

GAS TURBINES, EQUIPMENT AND ACCESSORIES FOR

Aviation Traders (Engineering) Ltd.	34 adv.
Burnley Aircraft Products Ltd.	65 „
Continental Motors Corporation	114 „
Hobson, H. M., Ltd.	71 „
Jessop, William & Sons, Ltd.	110 „
Orenda Engines Ltd.	68 „
Plessey Co., Ltd., The	101 „
Solar Aircraft Company	47 „
Western Manufacturing (Reading) Ltd.	81 „

GASKETS

Dunlop Rubber Co., Ltd.	104 „

GAUGES

Dobbie McInnes Ltd.	85 „
Hobson, H. M. Ltd.	71 „
Plessey Co., Ltd., The	101 „

GAUGES, FUEL AND OIL

Dobbie McInnes Ltd.	85 „

GAUGES, TYRE PRESSURE

Dunlop Rubber Co., Ltd.	104 „

GEARS

Brown, S. G. Ltd.	88 „

GENERATORS FOR AIRCRAFT

	PAGE
British Thomson-Houston Co., Ltd., The	61 adv.
English Electric Co., Ltd., The	22 & 90 „
Jack & Heintz	53 „
Newton Bros. (Derby) Ltd.	75 „

GOVERNORS, SPEED

Iso-Speedic Co., Ltd., The	5 „

GRINDING MACHINES

Edwards, F. J., Ltd.	9 „

GROUND, WORKSHOP AND HANGAR EQUIPMENT

Aviation Traders (Engineering) Ltd.	34 adv.
H.M.L. (Engineering) Ltd.	43 „

GUIDED MISSILES

Bell Aircraft Corporation	82 „
Brown, S. G., Ltd.	88 „
Convair (A Division of General Dynamics Corporation)	106 „
Martin, The Glenn L. Co.	40 „
M.S.S. Recordings Co. Ltd.	89 „
Solar Aircraft Company	47 „
Thompson Brothers (Bilston) Ltd.	48 „

GUILLOTINES

Edwards, F. J., Ltd.	9 „

GUN FEEDS

Martin-Baker Aircraft Co., Ltd.	18 „

GUNNERY TRAINING APPARATUS

M.L. Aviation Co., Ltd.	91 adv.
Martin, The Glenn L. Co.	40 „

HAND CREAM (INDUSTRIAL)

Cellon Ltd.	57 „

HANGAR DOORS

Esavian Ltd.	92 „

HANGARS

Bellman Hangars Ltd.	109 „

HANGER TEST STANDS

Heenan & Froude Ltd.	12 „

HARNESS, SAFETY

G.Q. Parachute Co., Ltd., The	56 „
M.L. Aviation Co., Ltd.	91 „
Mills Equipment Co., Ltd., The	85 „
Siebe, Gorman & Co., Ltd.	91 „

HEADPHONES

Brown, S. G. Ltd.	88 „

HEAT-RESISTING ALLOYS

Brown Foundries Co., The David	39 „
Fiat S.p.A.	38 „
Jessop, William & Sons, Ltd.	110 „

HELICOPTERS—COMMERCIAL

Bell Aircraft Corporation	82 „
Bristol Aeroplane Co., Ltd. The	95 & 96 „
Fiat S.p.A.	38 „
Omnipol Ltd. (Czechoslovakia)	32 „
Vertol Aircraft Corporation (U.S.A.)	4 „
Westland Aircraft Ltd.	8 „

HELICOPTERS—MILITARY

Bell Aircraft Corporation	82 „
Bristol Aeroplane Co., Ltd. The	95 & 96 „
Fiat S.p.A.	38 „
Omnipol Ltd. (Czechoslovakia)	32 „
Vertol Aircraft Corporation (U.S.A.)	4 „
Westland Aircraft Ltd.	8 „

HIGH ALTITUDE TESTING PLANT

Martin, The Glenn L. Co.	40 adv.
Normalair Ltd.	20 „

HIGH ALTITUDE PRESSURE SUITS

	PAGE
Siebe, Gorman & Co., Ltd.	91 adv.

HIGH FATIGUE AIRCRAFT BOLTS

Fiat S.p.A.	38 adv.

HIGH SPEED RECORDING CAMERAS

Brown, S. G. Ltd.	88 „

HIGH SPEED RESEARCH CAMERAS

Vinten, W. Ltd.	90 adv.

HIGH TEMPERATURE MATERIALS

Fiat S.p.A.	38 adv.
Low Moor Alloy Steelworks Ltd.	29 „
Wiggin, Henry & Co., Ltd.	107 „

HOSE AND COUPLINGS, HYDRAULIC AND FUEL

Automotive Products Co., Ltd.	28 adv.
Dunlop Rubber Co., Ltd.	104 „

HUMIDIFICATION EQUIPMENT

Normalair Ltd.	20 „

HYDRAULIC EQUIPMENT

Automotive Products Co., Ltd.	28 „
Boulton Paul Aircraft Ltd.	64 „
Dunlop Rubber Co., Ltd.	104 „
Fairey Aviation Co., Ltd., The	62 „
Goodyear Tyre & Rubber Co. (Great Britain) Ltd., The	58 „
H.M.L. (Engineering) Ltd.	43 „
Hobson, H. M. Ltd.	71 „
Integral Ltd.	85 „
Plessey Co., Ltd., The	101 „

HYDRAULIC MACHINES AND PRESSES

Edwards, F. J., Ltd.	9 adv.

HYDRAULIC PRESSURE PUMPS

Goodyear Tyre & Rubber Co. (Great Britain) Ltd., The	58 „
H.M.L. (Engineering) Ltd.	43 „
Integral Ltd.	85 „
Plessey Co., Ltd., The	101 „

HYDRAULIC TEST UNITS, MOBILE AND STATIC

H.M.L. (Engineering) Ltd.	43 „

INDICATORS, ENGINE AND TANK

Dobbie McInnes Ltd.	85 adv.

INDUSTRIAL AND WORKSHOP BUILDINGS

Bellman Hangars Ltd.	109 „

IGNITION ACCESSORIES

British Thomson-Houston Co., Ltd., The	61 „
Plessey Co., Ltd., The	101 „

INSTRUMENTATION CAMERAS

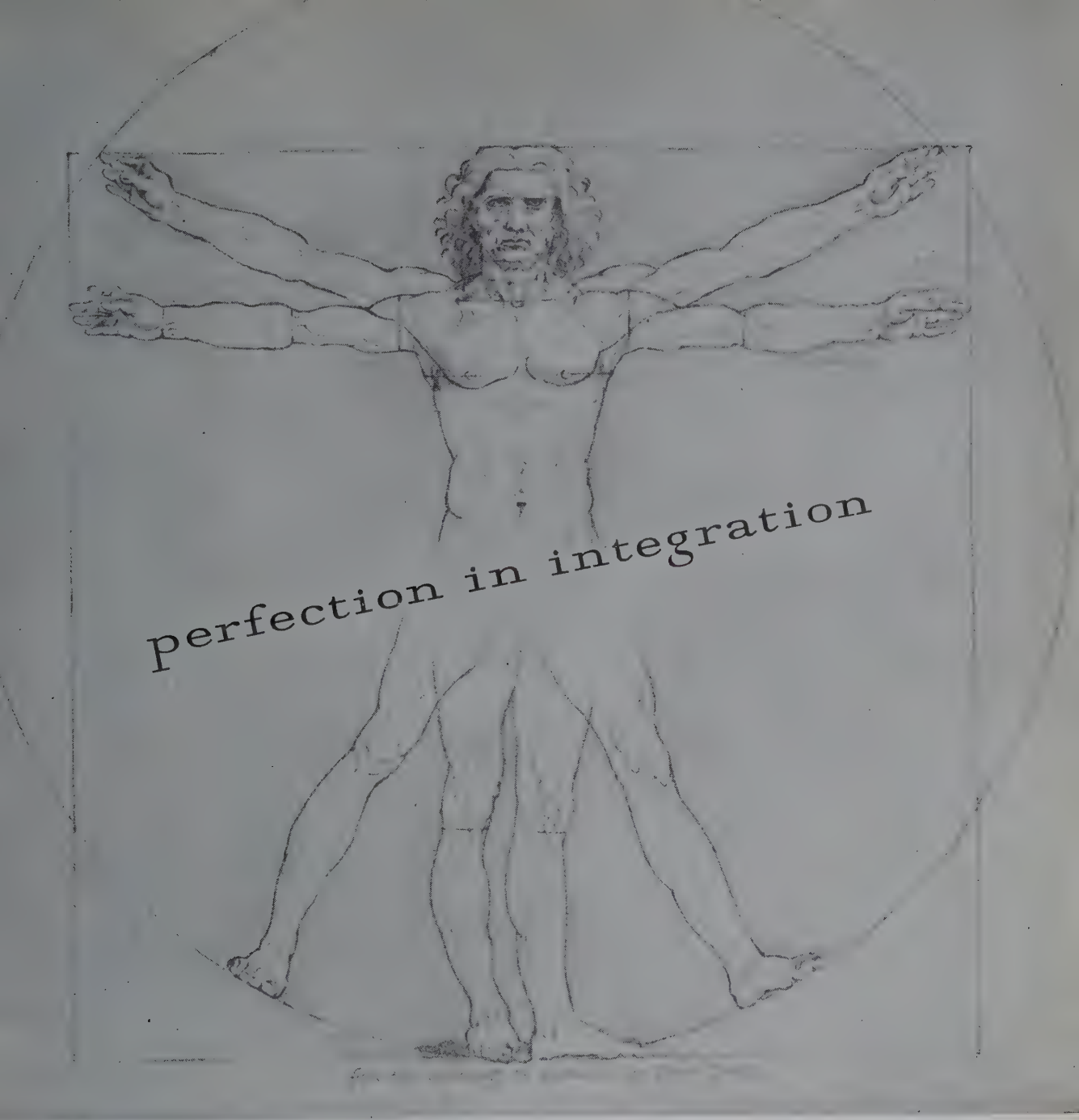
Vinten, W. Ltd.	90 „

INSTRUMENTS, AIRCRAFT

Anglo American Aviation Company	87 „
Avco-Lycoming	111 „
Brown, S. G. Ltd.	88 „
Ferranti Ltd.	67 „
Fiat S.p.A.	38 „
Kollsman Instrument Corporation (U.S.A.)	100 „
Omnipol Ltd. (Czechoslovakia)	32 „
Siebe, Gorman & Co., Ltd.	91 „
Sperry Gyroscope Co., Ltd., The	50 „

INSTRUMENTS, BLIND FLYING

Kollsman Instrument Corporation (U.S.A.)	100 „
Sperry Gyroscope Co., Ltd., The	50 „



Perfect integration is vital to efficient aircraft cabin air conditioning

It can best be assured by an organisation which can handle the design and production of the entire conditioning system

NORMALAIR is the only such organisation in Great Britain

NORMALAIR YEOVIL ENGLAND

NORMALAIR (AUSTRALIA) PTY. LTD. MELBOURNE

NORMALAIR (CANADA) LTD. TORONTO

INSTRUMENTS, ELECTRONIC

	PAGE
Avco-Lycoming	111 adv.
Boulton Paul Aircraft Ltd.	64 ,,
Brown, S. G. Ltd.	88 ,,
Kollsman Instrument Corporation (U.S.A.)	100 ,,
Pye Ltd.	103 ,,

INSTRUMENTS, NAVIGATION

Avco-Lycoming	111 ,,
Brown, S. G. Ltd.	88 ,,
Dobbie McInnes Ltd.	85 ,,
Ferranti Ltd.	67 ,,
Kollsman Instrument Corporation (U.S.A.)	100 ,,
Omnipol Ltd. (Czechoslovakia)	32 ,,
Pye Ltd.	103 ,,
Sperry Gyroscope Co., Ltd., The	50 ,,

INSTRUMENTS, PRECISION

Barr & Stroud Ltd. (*Inside Back Cover*)	
Brown, S. G. Ltd.	88 adv.
Convair (A Division of General Dynamics Corporation)	106 ,,
Dobbie McInnes Ltd.	85 ,,
Ferranti Ltd.	67 ,,
Iso-Speedic Co. Ltd., The	5 ,,
Kollsman Instrument Corporation (U.S.A.)	100 ,,
Plessey Co., Ltd., The	101 ,,
Pye Ltd.	103 ,,
Sperry Gyroscope Co., Ltd., The	50 ,,

INSTRUMENTS, TEST EQUIPMENT

Amal Ltd.	27 adv.
Bryans Aeroquipment Ltd.	63 ,,
Dobbie McInnes Ltd.	85 ,,
Hobson, H. M. Ltd.	71 ,,
Kollsman Instrument Corporation (U.S.A.)	100 ,,
Omnipol Ltd. (Czechoslovakia)	32 ,,
Plessey Co., Ltd., The	101 ,,
Pye Ltd.	103 ,,

INSULATION, ELECTRICAL

British Insulated Callender's Cables Ltd.	105 ,,

INSURANCE, AERO

British Aviation Insurance Co., Ltd., The	59 ,,

INTERCOMMUNICATION EQUIPMENT

Brown, S. G. Ltd.	88 ,,

INTERCOOLERS

Marston Excelsior Ltd.	81 ,,

JET CALIBRATING MACHINES

Amal Ltd.	27 ,,

JET ENGINE COMBUSTION EQUIPMENT, MANUFACTURE OF

Burnley Aircraft Products Ltd.	65 ,,
Solar Aircraft Company	47 ,,

JET ENGINE COMBUSTION EQUIPMENT, REPAIR OF

Burnley Aircraft Products Ltd.	65 ,,

JET ENGINE TEST PLANT

Avco-Lycoming	111 ,,
Heenan & Froude Ltd.	12 ,,
Hispano Suiza	36 ,,

JET PROPULSION ENGINES

Blackburn & General Aircraft Ltd.	66 ,,
Bristol Aeroplane Co., Ltd., The	95 & 96 ,,
de Havilland Enterprise, The	2, 25 & 108 ,,
Fiat S.p.A.	38 ,,
Hispano Suiza	36 ,,

JETTISONABLE CANOPY MECHANISMS

M.L. Aviation Co., Ltd.	91 adv.

JOINTING MATERIAL

British Insulated Callender's Cables Ltd.	105 ,,
Cellon Ltd.	57 ,,

LACQUERS

Cellon Ltd.	57 ,,
Fiat S.p.A.	38 ,,

LAMINATES

Fiat S.p.A.	38 ,,
Marston Excelsior Ltd.	81 ,,

LAMPS—AIRSTRIP, OBSTRUCTION (VEHICLE)

Butlers Ltd.	42 adv.

LAMPS, COCKPIT

British Thomson-Houston Co., Ltd., The	61 ,,
Butlers Ltd.	42 ,,

LAMPS FOR GROUND STATIONS

Butlers Ltd.	42 ,,

LAMPS, INSPECTION

British Thomson-Houston Co., Ltd., The	61 ,,
Butlers Ltd.	42 ,,

LATHES

Edwards, F. J., Ltd.	9 ,,
Fiat S.p.A.	38 ,,

LATHES, CAPSTAN

Edwards, F. J., Ltd.	9 ,,

LATHES, TURRET

Edwards, F. J., Ltd.	9 ,,

LAUNCHES FOR AIRCRAFT STATIONS

Vosper Ltd.	44 adv.

LIFE RAFTS

Elliot Equipment Ltd.	45 ,,

LIFE SAVING EQUIPMENT

Elliot Equipment Ltd.	45 ,,
G.Q. Parachute Co., Ltd., The	56 ,,
Kidde, Walter Co., Ltd., The	35 ,,
M.L. Aviation Co., Ltd.	91 ,,
Martin-Baker Aircraft Co., Ltd.	18 ,,
Siebe, Gorman & Co., Ltd.	91 ,,

LIFE SAVING JACKETS

Elliot Equipment Ltd.	45 ,,
Kidde, Walter Co., Ltd., The	35 ,,
Siebe, Gorman & Co., Ltd.	91 ,,

LIGHTS, AIRCRAFT

Butlers Ltd.	42 ,,

LIGHTS, CABIN

Butlers Ltd.	42 ,,

LIGHTS, IDENTIFICATION

Butlers Ltd.	42 ,,

LIGHTS, LANDING

Butlers Ltd.	42 ,,

LIGHTS, NAVIGATION

Butlers Ltd.	42 ,,

LINE TELEPHONY EQUIPMENT

Brown, S. G. Ltd.	88 ,,

LININGS, BRAKE

Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The	58 ,,

LUBRICANTS

Esso Aviation Products	116 ,,
Fiat S.p.A.	38 ,,

MACHINE TOOLS

Edwards, F. J., Ltd.	9 ,,
Fiat S.p.A.	38 ,,

MACHINING

	PAGE
A.B.C. Motors Ltd.	88 adv.
Aviation Traders (Engineering) Ltd.	34 ,,
Cornercroft Ltd.	6 ,,
Dragonair Ltd.	86 ,,

MAGNETIC INDICATORS

Plessey Co., Ltd., The	101 ,,

MAGNETIC RECORDING EQUIPMENT

M.S.S. Recordings Co. Ltd.	89 adv.
Thermionic Products Ltd.	37 ,,

MAGNETOS

British Thomson-Houston Co., Ltd., The	61 ,,
Fiat S.p.A.	38 ,,

MAGNETS, INSTRUMENT

Jessop, William & Sons, Ltd.	110 ,,

MARINE ENGINES

Fiat S.p.A.	38 ,,
Napier, D., & Son, Ltd.	*Inside front cover*
Vosper Ltd.	44 adv.

METAL FITTINGS

Aviation Traders (Engineering) Ltd.	34 ,,
Burnley Aircraft Products Ltd.	65 ,,
Mills Equipment Co., Ltd., The	85 ,,
Solar Aircraft Company	47 ,,
Western Manufacturing (Reading) Ltd.	81 ,,

METAL HONEYCOMB

Solar Aircraft Company	47 ,,

METAL/RUBBER JOINTING

Dunlop Rubber Co., Ltd.	104 ,,

METERING LUBRICATION PUMPS

Plessey Co., Ltd., The	101 adv.

METERS, FLOW

Amal Ltd.	27 ,,

MICRO-WAVE TEST EQUIPMENT

Ferranti Ltd.	67 adv.

MILLING MACHINES

Edwards, F. J., Ltd.	9 ,,
Fiat S.p.A.	38 ,,

MOTOR CARS

Alvis Ltd.	113 ,,
Bristol Aeroplane Co., Ltd., The	95 & 96 ,,
Fiat S.p.A.	38 ,,
Hawker Siddeley Group Ltd.	115 ,,
Svenska Aeroplan A.B. (Saab Aircraft Co.)	16 ,,

MOTORS, ELECTRIC

British Thomson-Houston Co., Ltd., The	61 ,,
Brown, S. G. Ltd.	88 ,,
English Electric Co., Ltd., The	22 & 90 ,,
Fiat S.p.A.	38 ,,
Jack & Heintz	53 ,,
Newton Brothers (Derby) Ltd.	75 ,,
Plessey Co., Ltd., The	101 ,,
Western Manufacturing (Reading) Ltd.	81 ,,

NAME PLATES

Barr & Stroud Ltd.	*Inside back cover*
Vosper Ltd.	44 adv.

NIBBLING MACHINES

Desoutter Brothers Ltd.	14 ,,
Edwards, F. J., Ltd.	9 ,,

NIMONIC ALLOYS

Fiat S.p.A.	38 ,,
Wiggin, Henry & Co., Ltd.	107 ,,



The Incomparable P.1B

This all-weather supersonic day and night fighter has been ordered in quantity for the Royal Air Force. With an all round performance better than any comparable aircraft in the world, and extensive armament including guided missiles, it represents an outstanding achievement in the field of military aviation.

'ENGLISH ELECTRIC' aircraft

THE ENGLISH ELECTRIC COMPANY LIMITED · MARCONI HOUSE · 336/7 STRAND · LONDON · WC2

A MEMBER OF THE ENGLISH ELECTRIC AVIATION GROUP

OILS PAGE
Esso Aviation Products .. 116 adv.
Fiat S.p.A. .. .. .. 38 ,,

OIL SEALS
Dunlop Rubber Co., Ltd. .. 104 ,,

OPTICAL GUNSIGHTS
Avco-Lycoming .. .. .. 111 ,,
Barr & Stroud Ltd. (*Inside Back Cover*)
Kollsman Instrument Corporation (U.S.A.) .. .. 100 adv.

ORDNANCE ROCKETS
Fiat S.p.A. .. .. .. 38 ,,

OXYGEN APPARATUS
British Oxygen Aro Equipment Ltd. .. .. 49 ,,
Elliot Equipment Ltd. .. 45 ,,
Kidde, Walter Co., Ltd., The 35 ,,
Normalair Ltd. .. .. .. 20 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PAINT REMOVER
Cellon Ltd. .. .. .. 57 ,,

PAINTS AND VARNISHES
Cellon Ltd. .. .. .. 57 ,,
Fiat S.p.A. .. .. .. 38 ,,
Titanine Ltd. .. .. .. 46 ,,

PARACHUTES, LIFE SAVING
G.Q. Parachute Co., Ltd., The 56 ,,
Irving Air Chute of Great Britain Ltd., The .. .. .. 73 ,,
Omnipol Ltd. (Czechoslovakia) 32 ,,

PARACHUTES, SUPPLIES DROPPING
G.Q. Parachute Co., Ltd., The 56 adv.
Irving Air Chute of Great Britain Ltd., The .. .. .. 73 ,,

PARACHUTES, TROOP LANDING
G.Q. Parachute Co., Ltd., The 56 ,,
Irving Air Chute of Great Britain Ltd., The .. .. .. 73 ,,

PETROL
BP Aviation Service .. .. 55 ,,
Esso Aviation Products .. 116 ,,
Fiat S.p.A. .. .. .. 38 ,,

PHOTOGRAPHIC EQUIPMENT
Vinten, W. Ltd. .. .. 90 ,,

PINS—QUICK RELEASE
Western Manufacturing (Reading) Ltd. .. .. 81 ,,

PLASTIC FABRICATIONS
Fairey Aviation Co., Ltd., The 62 ,,
Fiat S.p.A. .. .. .. 38 ,,
Folland Aircraft Ltd. .. 98 ,,
Kidde, Walter Co., Ltd., The 35 ,,
Vosper Ltd. .. .. .. 44 ,,

PLASTIC MOULDINGS
Cornercroft Ltd. .. .. 6 ,,
Fairey Aviation Co., Ltd., The 62 ,,
Folland Aircraft Ltd. .. 98 ,,
Vosper Ltd. .. .. .. 44 ,,
Western Manufacturing (Reading) Ltd. .. .. 81 ,,

PLASTICS, TRANSPARENT
Fairey Aviation Co., Ltd., The 62 ,,
Fiat S.p.A. .. .. .. 38 ,,
Folland Aircraft Ltd. .. 98 ,,

PLUGS AND SOCKETS
Plessey Co., Ltd., The .. 101 ,,
Pye Ltd. .. .. .. 103 ,,
Western Manufacturing (Reading) Ltd. .. .. 81 ,,

POWER CONTROLS FOR AIRCRAFT PAGE
Boulton Paul Aircraft Ltd. .. 64 adv.

POWER PRESSES
Edwards, F. J., Ltd. .. .. 9 ,,

PRECISION WORK
A.B.C. Motors Ltd. .. .. 88 ,,
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Brown, S. G. Ltd. .. .. 88 ,,
Cornercroft Ltd. .. .. 6 ,,
Iso-Speedic Co., Ltd., The .. 5 ,,
Plessey Co., Ltd., The .. 101 ,,
Short Bros. & Harland Ltd. .. 52 ,,

PREFABRICATED ALUMINIUM ALLOY STRUCTURES
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Cornercroft Ltd. .. .. 6 ,,

PRE-FORMED WIRING ASSEMBLIES
Plessey Co., Ltd., The .. 101 adv.

PREPACK DINGHY STOWAGE
Kidde Walter Co., Ltd., The 35 ,,

PREPACKAGING
Geo. Salter & Co., Ltd. .. 92 ,,

PRESSURE CABIN CONTROL VALVES
Normalair Ltd. .. .. .. 20 adv.

PRESSURE REGULATING VALVES, FLUIDS AND GASES
Amal Ltd. .. .. .. 27 ,,
Dunlop Rubber Co., Ltd. .. 104 ,,
Integral Ltd. .. .. .. 85 ,,
Kidde, Walter Co., Ltd., The 35 ,,
Normalair Ltd. .. .. .. 20 ,,
Plessey Co., Ltd., The .. 101 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PRESS TOOL SETS (STANDARDISED)
Desoutter Brothers Ltd. .. 14 adv.

PRESS WORK
Burnley Aircraft Products Ltd. 65 ,,
Cornercroft Ltd. .. .. 6 ,,
Folland Aircraft Ltd. .. 98 ,,
Plessey Co., Ltd., The .. 101 ,,
Short Bros. & Harland Ltd. .. 52 ,,
Western Manufacturing (Reading) Ltd. .. .. 81 ,,

PROPELLER TEST STANDS
Heenan & Froude Ltd. .. 12 ,,

PROPELLER HUBS
de Havilland Enterprise, The 2, 25 & 108 ,,
Martin-Baker Aircraft Co., Ltd. 18 ,,

PROPELLER SHAFTS
de Havilland Enterprise, The 2, 25 & 108 ,,

PROPELLERS
de Havilland Enterprise, The 2, 25 & 108 ,,
Fairey Aviation Co., Ltd., The 62 ,,
Fiat S.p.A. .. .. .. 38 ,,
Omnipol Ltd. (Czechoslovakia) 32 ,,

PROTECTIVE CLOTHING
M.L. Aviation Co., Ltd. .. 91 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PUBLIC ADDRESS EQUIPMENT
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 ,,
Redifon Ltd. .. .. .. 118 ,,

PUBLISHERS PAGE
Iliffe & Sons, Ltd. .. .. 3 adv.
Sampson Low, Marston & Co., Ltd. .. .. 88 ,,

PUMPS, AIR COMPRESSOR
Dunlop Rubber Co., Ltd. .. 104 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PUMPS, FUEL AND OIL
A.B.C. Motors Ltd. .. .. 88 ,,
Cornercroft Ltd. .. .. 6 ,,
Plessey Co., Ltd., The .. 101 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PUMPS, HYDRAULIC
A.B.C. Motors Ltd. .. .. 88 ,,
Anglo American Aviation Company .. .. .. 87 ,,
Automotive Products Co., Ltd. 28 ,,
Goodyear Tyre & Rubber Co. (Great Britain) Ltd. .. .. 58 ,,
H.M.L. (Engineering) Ltd. .. 43 ,,
Integral Ltd. .. .. .. 85 ,,
Plessey Co., Ltd., The .. 101 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PUMPS, VACUUM
Plessey Co., Ltd., The .. 101 ,,
Siebe, Gorman & Co., Ltd. .. 91 ,,

PUNCHING AND SHEARING MACHINERY
Edwards, F. J., Ltd. .. .. 9 ,,

QUARTZ CRYSTALS
Brush Crystal Co., Ltd. .. 37 ,,
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 ,,

RADAR FOR NAVIGATION, WARNING, INTERCEPTION, FIRE CONTROL AND AIRFIELD SUPERVISION
Avco-Lycoming .. .. .. 111 adv.
Ferranti Ltd. .. .. .. 67 ,,
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 ,,
Martin, The Glenn L. Co. .. 40 ,,

RADIATORS
Marston Excelsior Ltd. .. 81 ,,

RADIO AIRPORT CONTROL EQUIPMENT
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 ,,

RADIO EQUIPMENT
Anglo American Aviation Company .. .. .. 87 ,,
Brush Crystal Co., Ltd. .. 37 ,,
Kollsman Instrument Corporation (U.S.A.) .. .. 100 ,,
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 ,,
Plessey Co., Ltd., The .. 101 ,,
Pye Ltd. .. .. .. 103 ,,
Redifon Ltd. .. .. 118 ,,
Standard Telephones and Cables Ltd. .. .. .. 77 ,,
Thermionic Products Ltd. .. 37 ,,

RADIO NAVIGATION EQUIPMENT
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 ,,

RADIO OVERHAUL
Aviation Traders (Engineering) Ltd. .. .. 34 ,,
Fiat S.p.A. .. .. .. 38 ,,
Vosper Ltd. .. .. .. 44 ,,

RADIO SCREENING FITTINGS
Plessey Co., Ltd., The .. 101 ,,

Marconi's Hand in Air Power



The swift, lucid and secure flow of "intelligence" combined with accurate navigation are the essentials of successful air operations. Marconi's, working in conjunction with the British and other governments, have contributed more of the means to achieving these essentials than any other commercial undertaking. Thirty-two air forces rely on Marconi radio communications, navigational aids or radar. Marconi's are re-equipping the radar formations of the R.A.F. Integrated sea and air warning networks have been engineered by Marconi's in many parts of the world. Airfields all over the world rely on Marconi ground radio and radar.

MARCONI

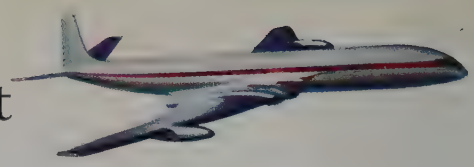
Planning and Installation of Airport and Airborne Radio Systems and Ground Radar

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX

LA 25

Incomparable travel comfort

. . . at more than 500 m.p.h.





No aircraft challenges the Comet's combination of jet speed and jet smoothness with world-wide operational suitability

The intercontinental Comet carries about 55 to 80 passengers on 3,000-mile stages at more than 500 m.p.h.

The continental Comet carries about 80 to 100 passengers on short inter-city stages at up to 545 m.p.h.

Neither is dependent upon dense and continually growing traffic, or upon enlarged airports.

COMET

(ROLLS-ROYCE AVON R.A. 29 ENGINES)

DE HAVILLAND WORLD ENTERPRISE

RAFTS PAGE
Elliot Equipment Ltd. .. 45 adv.

RECORDERS, FLIGHT TEST EQUIPMENT
M.S.S. Recordings Co. Ltd. .. 89 „

RECORDERS, HIGH SPEED, MECHANICAL AND ELECTRONIC
Brown, S. G. Ltd. .. .. 88 „
Brush Crystal Co., Ltd. .. 37 „
Dobbie McInnes Ltd. .. 85 „
M.S.S. Recordings Co. Ltd. .. 89 „
Thermionic Products Ltd. .. 37 „

REFERENCE BOOKS
"Flight Handbook" .. .. 3 „
"Gas Turbines and Jet Propulsion for Aircraft" .. .. 3 „

REFUELLING LAUNCHES
Thompson Brothers (Bilston) Ltd. 48 „
Vosper Ltd. .. .. .. 44 „

REPAIR AND MAINTENANCE OF AIRCRAFT
Aviation Traders (Engineering) Ltd. .. .. 34 „
de Havilland Enterprise, The 2, 25 & 108 „
Fairey Aviation Co., Ltd. The 62 „
Fokker, N. V. Koninkluke Nederlandse Vliegtuigenfabriek 80 „
Hawker Siddeley Group Ltd. 115 „
Omnipol Ltd. (Czechoslovakia) 32 „

REPAIR AND OVERHAUL OF AERO ENGINES
Avco-Lycoming .. .. .. 111 „
Burnley Aircraft Products Ltd. 65 „
de Havilland Enterprise, The 2, 25, & 108 „
Hawker Siddeley Group Ltd. .. 115 „
Omnipol Ltd. (Czechoslovakia) 32 „

REPETITION WORK
A.B.C. Motors Ltd. .. .. 88 „
Cornercroft Ltd. .. .. 6 „
Plessey Co., Ltd., The .. 101 „
Western Manufacturing (Reading) Ltd. .. .. 81 „

RESCUE CRAFT
Vosper Ltd. .. .. .. 44 „
Vertol Aircraft Corporation (U.S.A.) .. .. .. 4 „

RESINS (SYNTHETIC)
Aero Research (Araldite) Ltd. 112 „

RETAINING RINGS
Geo. Salter & Co., Ltd. .. 92 „

RINGS—GAS TURBINE, FORGED
Fiat S.p.A. .. .. .. 38 adv.

ROLLER BEARINGS SINGLE AND DOUBLE ROW, SELF ALIGNING
Fiat S.p.A. .. .. .. 38 adv.

RUBBER ACCESSORIES
Dunlop Rubber Co., Ltd. .. 104 „

RUBBER MOULDING, PETROL AND OIL RESISTING
Dunlop Rubber Co., Ltd. .. 104 adv.

SALVAGE EQUIPMENT
Siebe, Gorman & Co., Ltd. .. 91 „

SCIENTIFIC INSTRUMENTS
Barr & Stroud Ltd. *Inside Back Cover*
Dobbie McInnes Ltd. .. 85 adv.
Ferranti Ltd. .. .. .. 67 „
Plessey Co., Ltd., The .. 101 „
Pye Ltd. .. .. .. 103 „

SEALING RINGS
Dunlop Rubber Co., Ltd. .. 104 „

SEAPLANE, TENDERS PAGE
Vosper Ltd. .. .. .. 44 adv.

SEARCHLIGHTS CRASH TENDER, FIRE FIGHTING VEHICLE
Butlers Ltd. .. .. .. 42 adv.

SEATS, CIVIL AND MILITARY
Fairey Aviation Co., Ltd., The 62 „
Vickers-Armstrongs Ltd. 93 & 94 „

SHAPING MACHINES
Edwards, F. J., Ltd. .. .. 9 „

SHEARING MACHINES
Edwards, F. J., Ltd. .. .. 9 „

SHEET, LIGHT METAL
British Insulated Callender's Cables Ltd. .. .. 105 „
Northern Aluminium Co., Ltd. 119 „

SHEET, STAINLESS AND HEAT-RESISTING STEEL
Fiat S.p.A. .. .. .. 38 „
Fox, Samuel & Co., Ltd. .. 117 „

SHEET METAL WORK
Aviation Traders (Engineering) Ltd. .. .. .. 34 „
Burnley Aircraft Products Ltd. 65 „
Cornercroft Ltd. .. .. 6 „
Dragonair Ltd. .. .. 86 „
Edwards, F. J. Ltd. .. .. 9 „
Fiat S.p.A. .. .. .. 38 „
Folland Aircraft Ltd. .. .. 98 „
Marston Excelsior Ltd. .. 81 „
Solar Aircraft Company .. 47 „
Western Manufacturing (Reading) Ltd. .. .. 81 „

SHOCK-ABSORBERS, OLEO-PNEUMATIC
Automotive Products Co., Ltd. 28 „
Boulton Paul Aircraft Ltd. .. 64 „
Fairey Aviation Co., Ltd., The 62 „

SHOCK-ABSORBERS, RUBBER
Dunlop Rubber Co., Ltd. .. 104 „
Sperry Gyroscope Co., Ltd., The 50 „

SIGNALLING SYSTEMS AND APPARATUS
M.L. Aviation Co., Ltd. .. 91 „
Standard Telephones and Cables, Ltd. .. .. 77 „

SLEEVE TARGETS
Elliot Equipment Ltd. .. 45 „

SPARES MISCELLANEOUS
Anglo American Aviation Company .. .. .. 87 „

SPEED CONTROL DEVICES
Iso-Speedic Co., Ltd., The .. 5 „

SPRINGS
Fox, Samuel & Co., Ltd. .. 117 „
Geo. Salter & Co., Ltd. .. 92 „

STABILISING EQUIPMENT
Brown, S. G. Ltd. .. .. 88 „

STAMPINGS
Solar Aircraft Company .. 47 „

STEEL AND STEEL ALLOYS
Fiat S.p.A. .. .. .. 38 „
Fox, Samuel & Co., Ltd. .. 117 „
Habershon, J. J. & Sons, Ltd. 69 „
Jessop, William & Sons, Ltd. 110 „
Low Moor Alloy Steelworks Ltd. .. .. .. 29 „

STEEL, CREEP RESISTING PAGE
Fiat S.p.A. .. .. .. 38 adv.
Fox, Samuel & Co., Ltd. .. 117 „
Habershon, J. J. & Sons, Ltd. 69 „
Jessop, William & Sons, Ltd. 110 „
Low Moor Alloy Steelworks Ltd. 29 „

STEEL, HEAT-RESISTING
Fiat S.p.A. .. .. .. 38 „
Fox, Samuel & Co., Ltd. .. 117 „
Habershon, J. J. & Sons, Ltd. 69 „
Jessop, William & Sons, Ltd. 110 „
Low Moor Alloy Steelworks Ltd. 29 „

STEEL, STAINLESS AND RUSTLESS
Fiat S.p.A. .. .. .. 38 adv.
Fox, Samuel & Co., Ltd. .. 117 „
Habershon, J. J. & Sons, Ltd. 69 „
Jessop, William & Sons, Ltd. 110 „
Low Moor Alloy Steelworks Ltd. 29 „

STORAGE TANKS
Thompson Brothers (Bilston) Ltd. 48 „

STRIP, STAINLESS AND HEAT-RESISTING STEEL
Fiat S.p.A. .. .. .. 38 „
Fox, Samuel & Co., Ltd. .. 117 „

STRUTS—HYDRAULIC CYLINDERS, CHROMIUM PLATED
Van Der Horst Corporation of America .. .. .. 33 adv.

SUITS, CHEMICAL PROOF
Siebe, Gorman & Co., Ltd. .. 91 „

SUITS, FIREPROOF
Siebe, Gorman & Co., Ltd., .. 91 „

SUITS, FLASHPROOF
Siebe, Gorman & Co., Ltd. .. 91 „

SUITS, SURVIVAL
Elliot Equipment Ltd. .. 45 „
Siebe, Gorman & Co., Ltd. .. 91 „

SURVIVAL EQUIPMENT
Elliot Equipment Ltd. .. 45 „
Kidde, Walter Co., Ltd., The 35 „
Siebe, Gorman & Co., Ltd. .. 91 „

SWAGING MACHINES
Edwards, F. J., Ltd. .. .. 9 „

SWITCHGEAR
British Thomson-Houston Co., Ltd., The .. .. .. 61 „
Western Manufacturing (Reading) Ltd. .. .. 81 „

TANKS, PETROL, OIL AND WATER
Burnley Aircraft Products Ltd. 65 adv.
Marston Excelsior Ltd. .. .. 81 „
Thompson Brothers (Bilston) Ltd. 48 „

TARGET RELEASE AND EXCHANGER MECHANISMS
M.L. Aviation Co., Ltd. .. 91 „

TARGET TOWING WINCHES
M.L. Aviation Co., Ltd. .. 91 „

TECHNICAL PUBLICATIONS
"Aircraft Production" (Iliffe & Sons Ltd.) .. .. .. 3 „
Boulton Paul Aircraft Ltd. .. 64 „
"Flight" (Iliffe & Sons Ltd.) .. 3 „
Jessop, William & Sons, Ltd. .. 110 „
Sampson Low, Marston & Co., Ltd. .. .. 88 „

TENDERS FOR MARINE AIRCRAFT
Vosper Ltd. .. .. .. 44 adv.

TEST SHOP EQUIPMENT PAGE
Boulton Paul Aircraft Ltd. .. 64 adv.
Dragonair Ltd. .. .. 86 „
H.M.L. (Engineering) Ltd. .. 43 „
Heenan & Froude Ltd... .. 12 „
Hobson, H. M. Ltd. .. .. 71 „

THERMOMETER OIL POCKETS
Amal Ltd. .. .. .. 27 „

TOOLS
A.B.C. Motors Ltd. .. .. 88 „
Garringtons Ltd. .. .. 60 „
Jessop, William & Sons, Ltd. 110 „
Plessey Co., Ltd., The .. 101 „

TOOLS, CARBIDE AND CARBIDE TIPPED
Fiat S.p.A. .. .. .. 38 „
Jessop, William & Sons, Ltd. 110 „
Plessey Co., Ltd., The .. 101 „

TOOLS, ENGINEERS', SMALL, AERO MOTOR, ETC.
Anglo American Aviation Company .. .. .. 87 adv.
Jessop, William & Sons, Ltd. 110 „

TOOLS, PNEUMATIC AND ELECTRIC PORTABLE
Desoutter Brothers Ltd. .. 14 adv.

TOWED TARGETS
Elliot Equipment Ltd. .. 45 „

TOWED TARGETS (MARINE TYPE)
Vosper Ltd. .. .. .. 44 adv.

TRACTORS, AIRCRAFT TOWING PAGE
Brown, David, Tractors Ltd. .. 31 adv.
Fiat S.p.A. .. .. .. 38 „

TRAINING DEVICES
Aviation Traders (Engineering) Ltd. .. .. 34 „
Redifon Ltd. .. .. .. 118 „
Martin, The Glenn L. Co. .. 40 „

TRANSFORMER/RECTIFIER UNITS
British Thomson-Houston Co., Ltd., The .. .. .. 61 adv.

TRANSFORMERS, ROTARY, FOR RADIO
British Thomson-Houston Co., Ltd., The .. .. .. 61 „
English Electric Co., Ltd. The „ 22 & 90 „
Marconi's Wireless Telegraph Co., Ltd. .. .. .. 24 „
Newton Bros (Derby) Ltd. .. 75 „
Plessey Co., Ltd., The .. 101 „

TRANSPORT TANKS
Thompson Brothers (Bilston) Ltd. 48 „

TRAPS, FLAME
Amal Ltd. .. .. .. 27 „
Thompson Brothers (Bilston) Ltd. 48 „

TRUCKS—FORKLIFT AND PLATFORM
Fiat S.p.A. .. .. .. 38 adv.

TUBE—HIGH TENSILE BRASS
Fiat S.p.A. .. .. .. 38 „

TUBES, LIGHT METAL PAGE
Fiat S.p.A. .. .. .. 38 adv.
High Duty Alloys Ltd. .. 102 „
Northern Aluminium Co. Ltd. 119 „

TUBES, STAINLESS STEEL
Fiat S.p.A. .. .. .. 38 „
Solar Aircraft Company .. 47 „

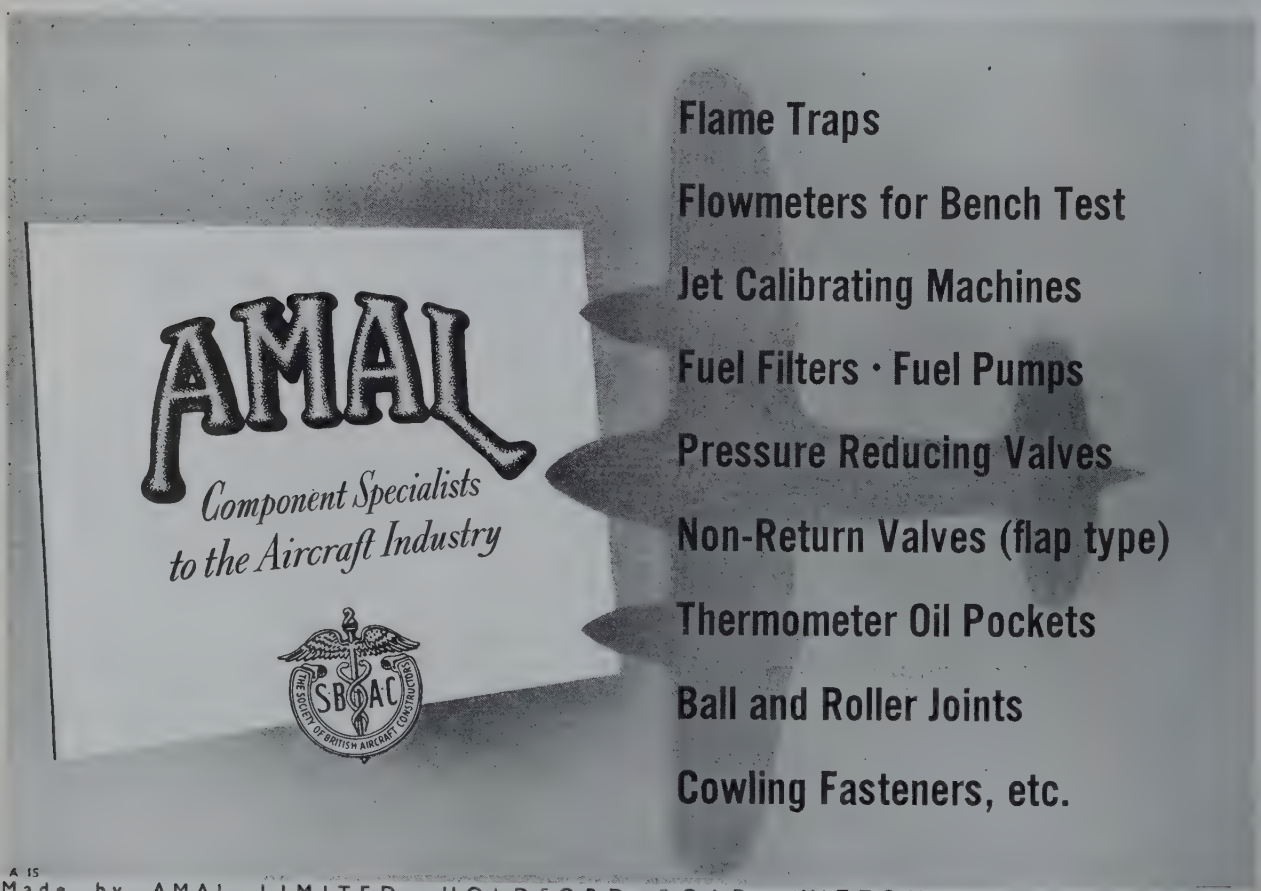
TUBES, STEEL
Fiat S.p.A. .. .. .. 38 „
Jessop William & Sons, Ltd. 110 „
Low Moor Fine Steels Ltd. .. 29 „

TUBING, FLEXIBLE
Dunlop Rubber Co., Ltd. .. 104 „
Plessey Co., Ltd., The .. 101 „

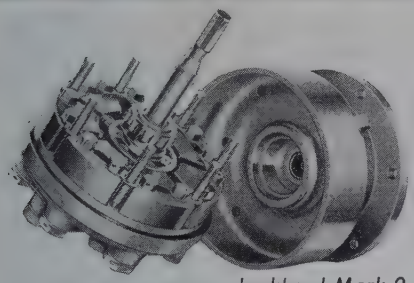
TURRETS, GUN
Boulton Paul Aircraft Ltd. .. 64 „
Bristol Aeroplane Co., Ltd., The 95 & 96 „
Martin, The Glenn L. Co. .. 40 „
Sperry Gyroscope Co., Ltd., The 50 „

TYRES FOR AIRCRAFT
Dunlop Rubber Co., Ltd .. 104 „
Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The 58 „
Omnipol Ltd. (Czechoslovakia) 32 „

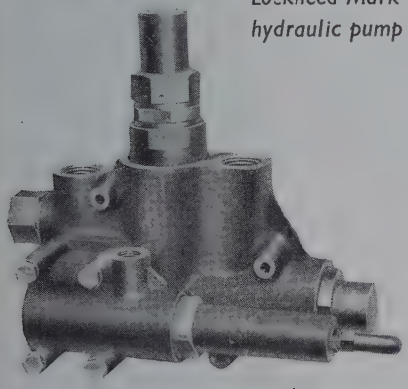
UNDERCARRIAGE EQUIPMENT
Automotive Products Co., Ltd. 28 „
Boulton Paul Aircraft Ltd. .. 64 „
Dunlop Rubber Co., Ltd .. 104 „
Goodyear Tyre & Rubber Co. (Great Britain) Ltd., The .. 58 „
Hispano Suiza .. .. .. 36 „



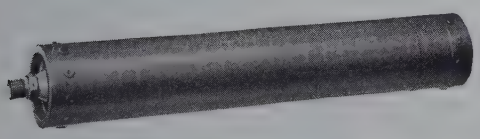
A 15
Made by AMAL LIMITED, HOLDFORD ROAD WITTON, BIRMINGHAM, 6



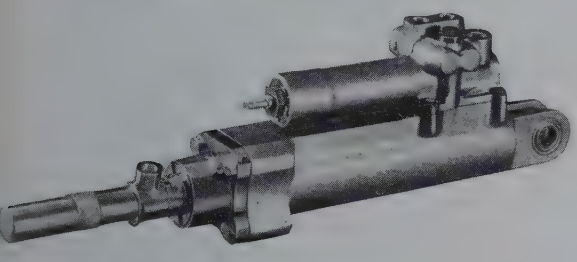
Lockheed Mark 9 hydraulic pump



Lockheed silent cut-out valve



Lockheed accumulator



Lockheed 'Servodyne'

Complete hydraulic systems for aircraft

The famous Lockheed Mark 7, 8 and 9 hydraulic pumps are used to actuate the hydraulic systems of many important aircraft. The Lockheed silent cut-out valve and the Lockheed accumulator are other important units used in conjunction with the Lockheed pump.

'Servodyne' powered flying controls

These fine units are backed by more than 14 years of continuous flying service in the air. They are used on many of the world's finest aircraft for elevators, ailerons and rudder controls.

Undercarriages

Lockheed undercarriages and retraction jacks are made in a wide range of types and sizes, for aircraft of every type.

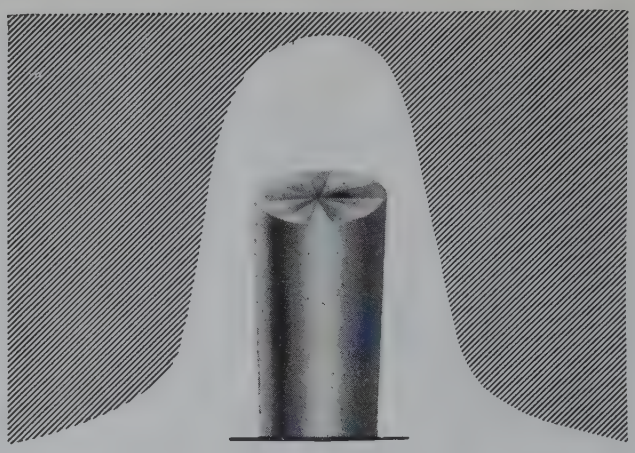
AUTOMOTIVE PRODUCTS COMPANY LTD., LEAMINGTON SPA, WARWICKSHIRE, ENGLAND

Regd. Trade Marks: Lockheed, 'Servodyne'

ALL-BRITISH

Lockheed

FOREMOST IN HIGH-PRECISION HYDRAULICS



Special Steels

Low Moor Alloy and Special Steels are used by many of the world's most famous Aircraft and Aero-Engine manufacturers. The quality standards of these steels fulfil the most exacting requirements.

Extrusions

Low Moor Extruded Steel Sections play a vital role in Aircraft Manufacture. Machining time is greatly reduced and production out-put is immediately stepped-up.



for extrusions **LOW MOOR FINE STEELS Ltd.**

for all other forms **LOW MOOR ALLOY STEELWORKS Ltd.**

BRADFORD YORKSHIRE ENGLAND

Telephone: Bradford 77331 (9 Lines)

LMFS & AS/PPPS/34

29 adv.

UNDERCARRIAGE GEAR, RETRACTABLE PAGE

Automotive Products Co., Ltd. 28 adv.
Hispano Suiza .. .. .. 36 „

VALVES

A.B.C. Motors Ltd. .. .. 88 „
Jessop, William & Sons, Ltd. 110 „
Kidde, Walter Co., Ltd., The 35 „
Plessey Co., Ltd., The .. 101 „
Siebe, Gorman & Co. Ltd. .. 91 „

VALVES, ELECTRONIC

Ferranti Ltd. .. .. .. 67 „

VALVES AND MINIATURE RELAYS

Plessey Co., Ltd., The .. 101 adv.
Pye Ltd. .. .. .. 103 „
Standard Telephones & Cables Ltd. .. .. .. 77 „

VALVES FOR AERO-ENGINES

Jessop William, & Sons, Ltd. .. 110 „

VALVE GUIDES

Yorkshire Engineering Supplies Ltd. .. .. 86 „

VALVES, NON-RETURN, FUEL

Amal Ltd. .. .. .. 27 „
Plessey Co., Ltd., The .. 101 „

VISCOMETERS

Dobbie McInnes Ltd. .. .. 85 „
Ferranti Ltd. .. .. .. 67 „

VOLTAGE AND CURRENT REGULATORS

British Thomson-Houston Co. Ltd.. The .. .. .. 61 „
Ferranti Ltd. .. .. .. 67 „
Jack & Heintz .. .. .. 53 „
Newton Bros. (Derby) Ltd. .. 75 „

WADING SUITS

Siebe, Gorman & Co. Ltd. .. 91 „

WEBBING

Mills Equipment Co., Ltd., The 85 „

WEIGHING MACHINES

Geo. Salter & Co., Ltd. .. 92 „

WHEELING AND RAISING MACHINES

Edwards, F. J., Ltd. .. .. 9 adv.

WHEELS FOR AIRCRAFT

Anglo American Aviation Company .. .. .. 87 „
Dunlop Rubber Co., Ltd. .. 104 „
Goodyear Tyre & Rubber Co. (Gt. Brit.) Ltd., The .. 58 „

WINDSCREEN WIPERS, AIRCRAFT

Dunlop Rubber Co., Ltd. .. 104 adv.

WIND TUNNEL TESTING PLANT

English Electric Co., Ltd., The 22 & 90 „
Fairey Aviation Co., Ltd., The 62 „
Heenan & Froude Ltd. .. 12 „

WIRE

British Insulated Callender's Cables Ltd. .. .. .. 105 „
Fox, Samuel & Co., Ltd. .. 117 „

WIRE, LIGHT METAL

Northern Aluminium Co., Ltd. 119 „

WOODWORKING MACHINERY

Edwards, F. J., Ltd. .. 9 „

WORKSHOP BUILDINGS

Bellman Hangars Ltd... 109 „



The C-123 can't land on a postage stamp...

but almost any clearing is its landing field!

On almost any clearing—almost any field—you can safely land the Fairchild C-123 assault transport.

Actual short-field tests have demonstrated that the rugged C-123 is able to take off and land from *deeply eroded, sandy fields;* that it can work from unprepared clearings *under downwind conditions;* that it is capable of mass landings into ungraded "combat zones" . . . *at 8-second intervals.* And literally thousands of flights have proven that the C-123 requires *no more than 700 ft. for takeoffs and landings.* During these strenuous tests, no C-123 was lost, none was damaged.

What better proof of the C-123's near-universal assault and logistics capability?

FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN 10, MARYLAND

A Division of Fairchild Engine and Airplane Corporation

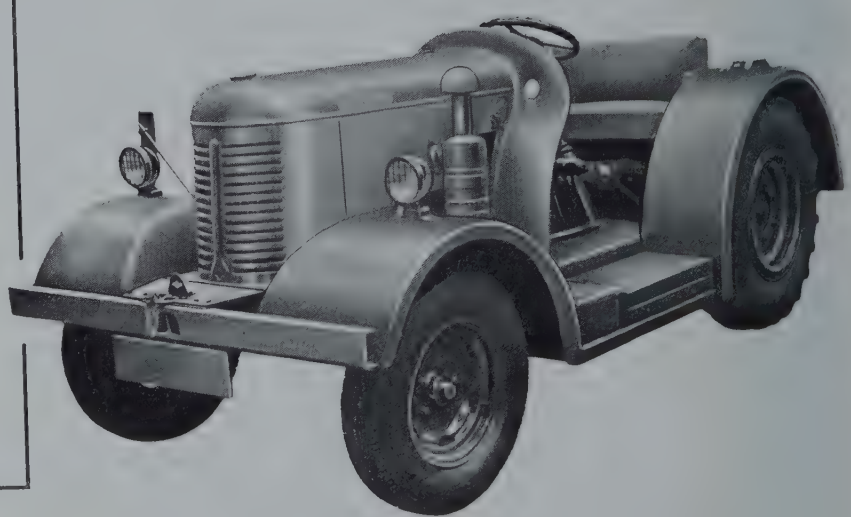
WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!



He handles it well in the Air . . .

be sure you handle it well on the Ground !

Use
DAVID BROWN
tractors.
Europe's largest
manufacturers of
Aircraft Towing
Vehicles.



DAVID BROWN CONSTRUCTION EQUIPMENT LTD. A subsidiary of David Brown Industries Limited.



Export and Import of
Sports and Transport Aircraft

OMNIPOL

LTD.

PRAGUE 3, WASHINGTONOVA 11
CZECHOSLOVAKIA

SPORTS AND TOURIST AIRCRAFT

TRAINING AIRCRAFT

SAILPLANES

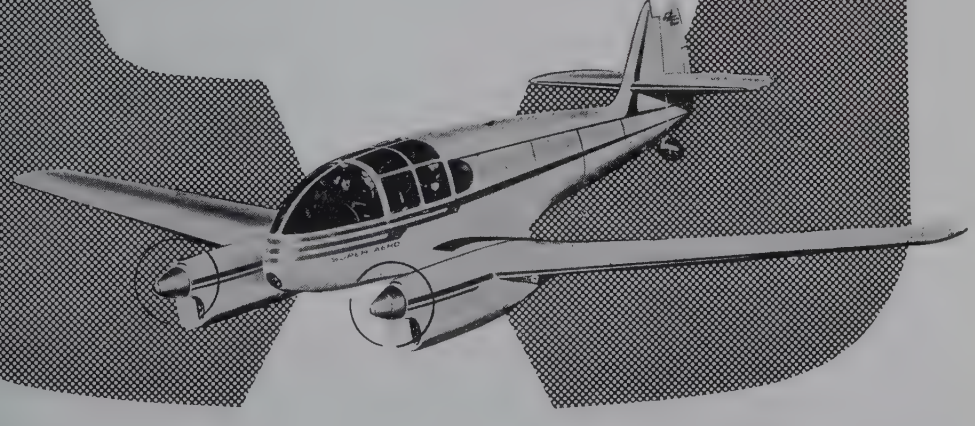
TRANSPORT AIRCRAFT

AIRCRAFT ENGINES

PROPELLERS

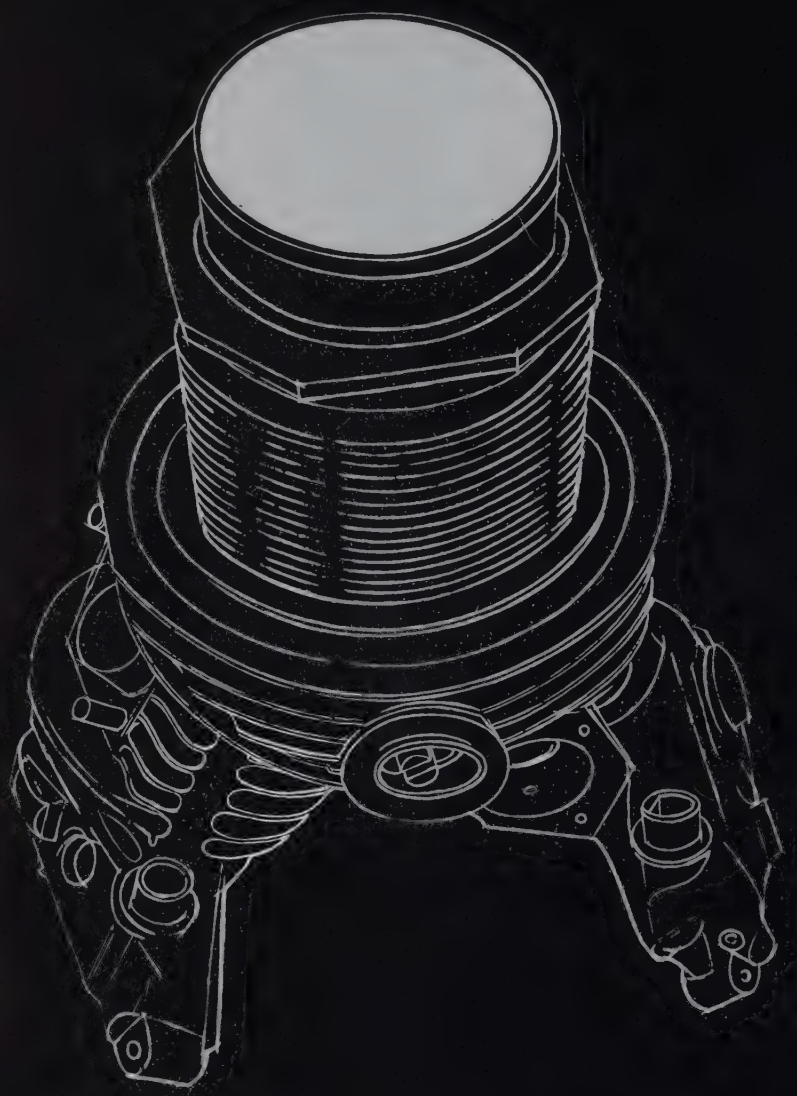
AIRCRAFT INSTRUMENTS

AIRFIELD LIGHTING EQUIPMENT



PORUS - KROME

Good for the Life of your Engines



RESISTS WEAR, ABRASION AND CORROSION.
REDUCES LUBRICATING OIL CONSUMPTION.
CAA APPROVED FOR BARREL RECLAMATION.

VAN DER HORST

HILVERSUM, HOLLAND

OLEAN, NEW YORK • LOS ANGELES, CALIFORNIA • TERRELL, TEXAS

THE ACCOUNTANT



★ *Economy of Operation*

★ *Ease of Maintenance*

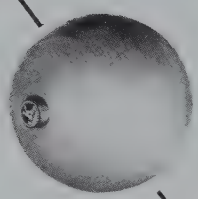
★ *Low Initial Cost*

AVIATION TRADERS (ENGINEERING) LTD.

HIGHER and HIGHER



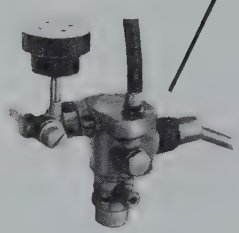
Portable oxygen breathing equipment specially designed with extra lightweight features for use in high-flying aircraft.



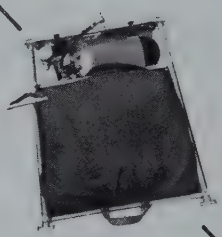
Glass fibre reinforced plastic pressure containers giving high strength/weight ratio, high impact and shatter resistance, dimensional stability, and resistance to a wide variety of chemicals. Suitable for gas and liquid working pressures up to 5000 p.s.i.

The need is for

TOUGHNESS
LIGHTNESS
DEPENDABILITY
COMPACTNESS



Carbon dioxide inflation equipment for dinghies, flotation bags and life jackets, suitable for operating over a wide range of applications and at very wide extremes of temperature.



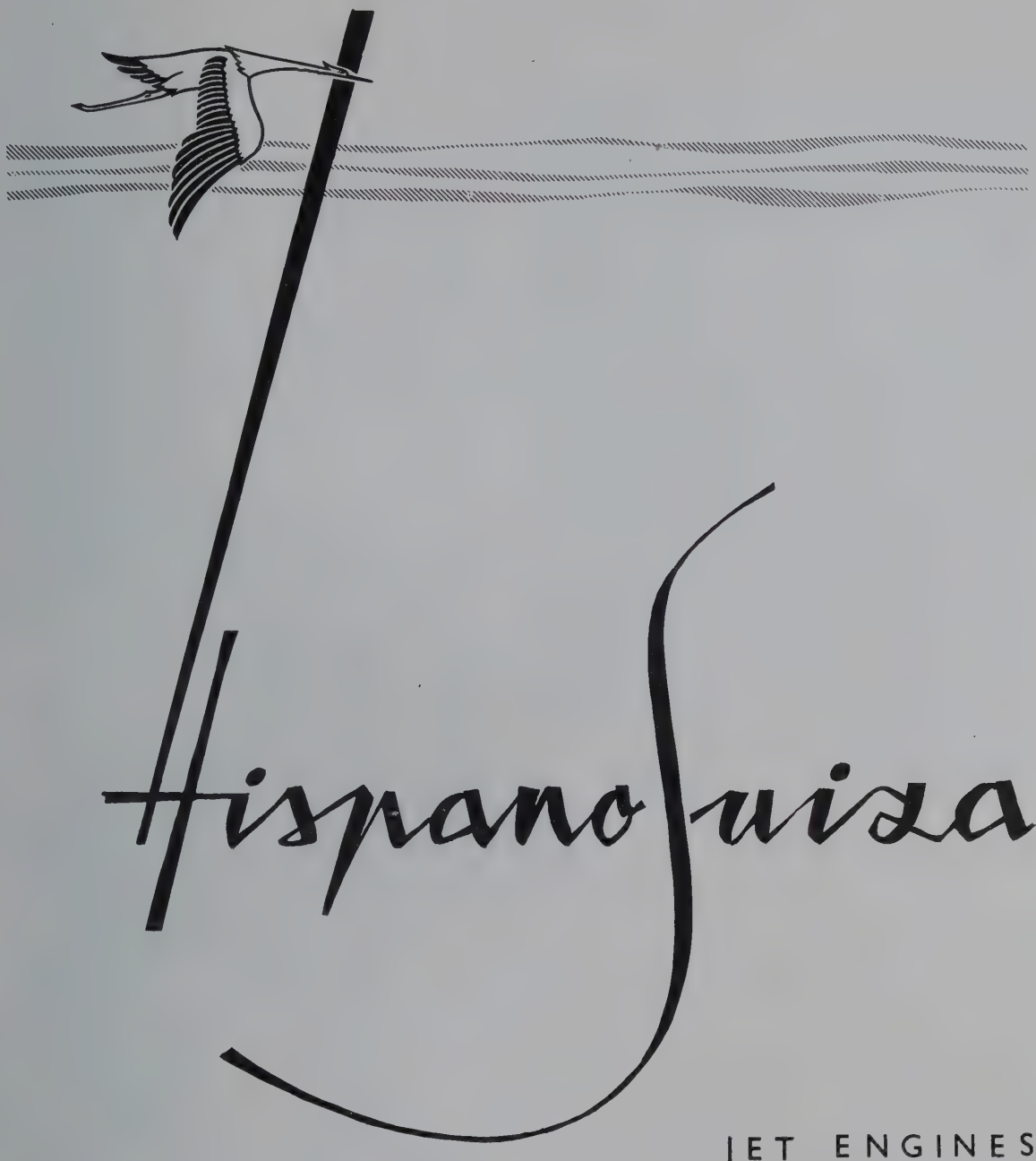
Pre-packed Dinghy stowage equipment specially developed for locked stowage of pre-packed 5-seater, 10-seater and 20-seater dinghies. Is designed to facilitate easy fitment and removal to and from aircraft stowage.

K
TRADE MARK
Kidde

THE WALTER KIDDE Co LTD

BELVUE ROAD, NORTHOLT, MIDDLESEX

Telephone: WAXLOW 1061

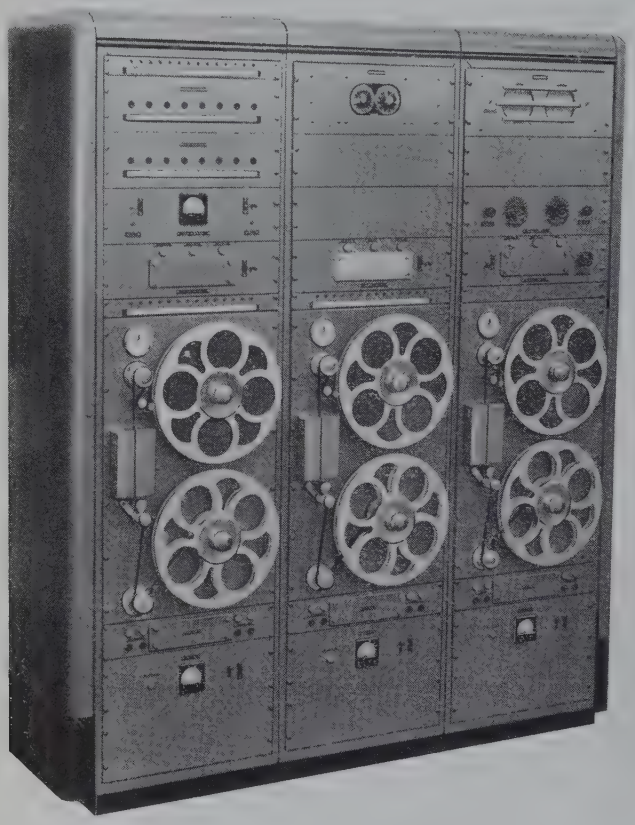


JET ENGINES
LANDING GEARS

BOIS-COLOMBES SEINE FRANCE

"FOR THE RECORD"

. . . round the World and round the Clock!



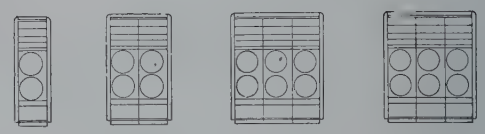
Capital outlay on recording equipment can now be scaled to the size of the airport. For the smaller field, the basic 4-channel THERMIONIC AIRPORT RECORDER is adequate — and economical. Further channels, up to a total of *fourteen*, are easily added as the airport's traffic grows. 'Ruggedised' valves and 'tropicalised' components keep maintenance costs remarkably low in any climatic conditions.

The

THERMIONIC MULTI-CHANNEL RECORDER

. . . and note these additional features

- Automatic monitoring on all channels if desired.
- Four wire input to enable "Receive" and "Send" circuits to be recorded on one channel with separate level controls.
- Automatic restart after power failure with remote indication.
- Special input circuits are available to enable the equipment to be used for switchboard monitoring.



Play-back Unit | MK III 16 hours recording | MK II 16 hours recording and playback | MK I 24 hours recording

FOR SMALL AIRFIELDS & LANDING GROUNDS

MARK VI. Eight hours continuous recording on up to fourteen channels with playback.

MARK VII. Sixteen hours continuous recording on up to fourteen channels with playback.

THERMIONIC PRODUCTS LTD.

Leaders in the field of magnetic recording

HYTHE · SOUTHAMPTON · ENGLAND

Telephone : HYTHE (Southampton) 3265/9

Cables : TECHNICO, HYTHE, SOUTHAMPTON

FIAT AVIATION

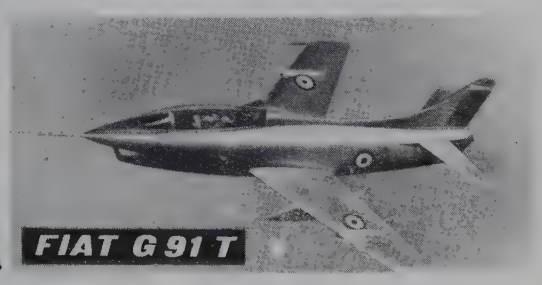


FIAT G 91

Light Ground Attack Fighter (NATO)

The fundamental characteristics of this aircraft are: limited dimensions, light weight, low first cost and operating costs, the possibility of operating from semi-prepared or grass runways.



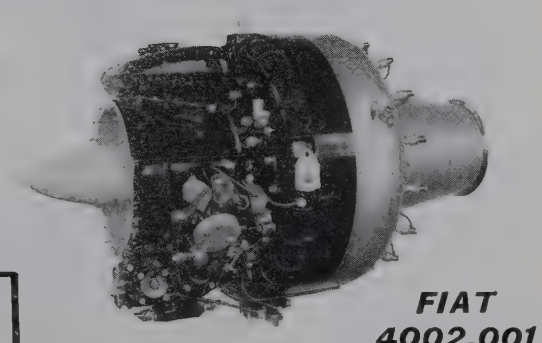


FIAT G 91 T

A two-seater version of the G 91 for advanced training in the supersonic region. It has all the essential characteristics of the single seater version. (Exceeds Mach 1).

FIAT 4002.001

Small power jet engine for aviation use.



FIAT - DIVISIONE AVIAZONE

200, Corso G. Agnelli - TURIN (Italy)

STEEL CASTINGS FOR AIRCRAFT



The heat resisting and high tensile steel castings illustrated are typical of the wide variety of complex airframe and engine components supplied to all leading aircraft manufacturers.

Modern foundry techniques and rigorous inspection, including examination by X-ray and gamma ray, ensure the outstanding reliability required by present day high performance aircraft.

High tensile castings are produced to the requirements of material specifications DTD 666 and 705.

THE

DAVID BROWN

CORPORATION (SALES) LIMITED

FOUNDRIES DIVISION

PENISTONE NEAR SHEFFIELD



TOP SCORE With a ten-year backlog of experience in pioneering the new age of rockets and guided missiles... and with five major projects currently in work for the U.S. Army, Navy and Air Force... Martin's contribution to design, development and operation in this advanced field of flight is continually expanding.

In 1946, development was commenced on the Martin MATADOR pilotless bomber for the Air Force... GORGON, a Navy test vehicle... and the VIKING series of high-altitude research rockets. Within two years these were followed by ORIOLE, an experimental air-to-air missile, and PLOVER, a target drone. More recent developments include LACROSSE for the Army... TITAN, the Intercontinental Ballistic Missile for the Air Force... and the launching vehicle for project VANGUARD, the earth satellite, undertaken with the Naval Research Laboratory as a major U. S. contribution to the worldwide science program of the forthcoming International Geophysical Year.

MARTIN

BALTIMORE · DENVER · ORLANDO

All Leading Aircraft Manufacturers and Operators

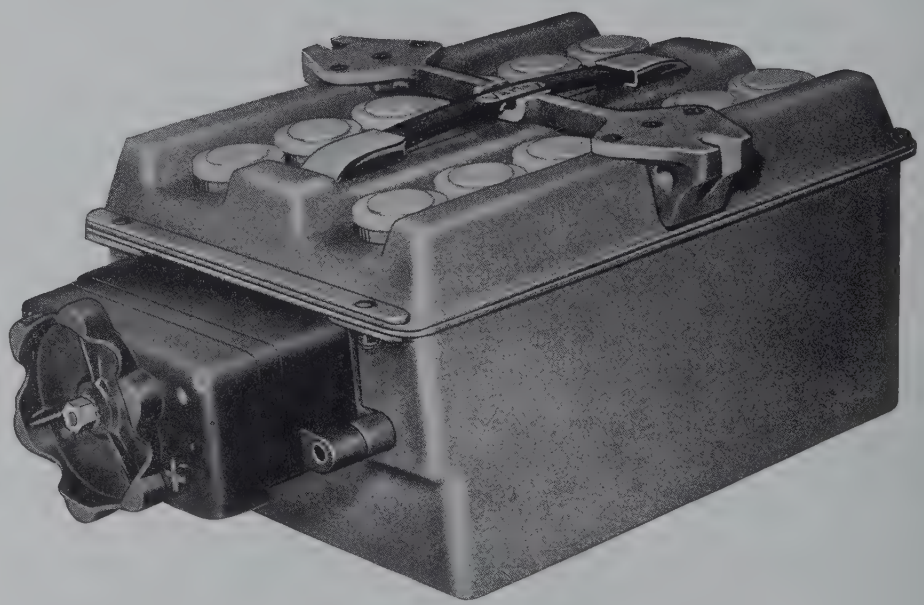
SPECIFY WITH CONFIDENCE

Varley

LIGHTWEIGHT AIRCRAFT BATTERIES

ENERGY/WEIGHT RATIO
HIGHEST EVER ACHIEVED WITH
STABILITY AND LONG LIFE

PROVED IN SERVICE
THROUGHOUT THE WORLD
UNDER ALL CONDITIONS



All Types are fully Aerobatic and Ventilated

TYPE 24.19/25C	
24 Volt. 25 A.h.	(10 hour rate)
20 A.h.	(2 hour rate)
18 A.h.	(1 hour rate)
Base dimensions	$9\frac{15}{16}'' \times 7\frac{11}{16}''$
Overall height	$6\frac{1}{8}''$
Weight fully charged	38 lbs.

DETAILS OF THIS AND OTHER TYPES FOR AIRCRAFT GUIDED MISSILES AND GROUND STARTING FROM :

VARLEY DRY ACCUMULATORS LIMITED

BY-PASS ROAD, BARKING, ESSEX

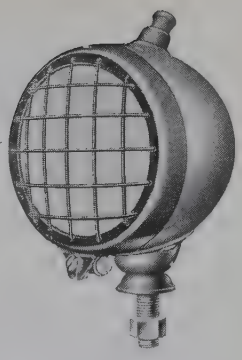


937 and 1052
AIRCRAFT LANDING LAMPS



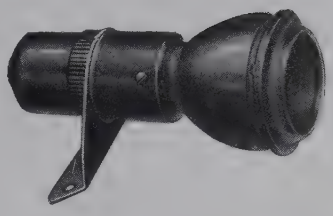
1121
SEARCHLIGHT
(Cab Control)

1465
DRIVING LIGHT
(Heavy-duty Crawler or Tractor)

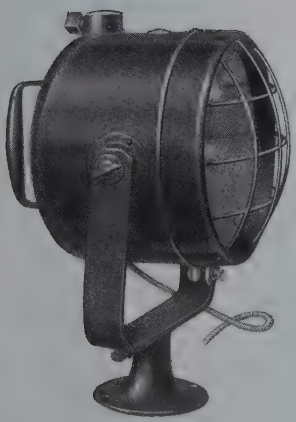


1113
TAXYING LAMP

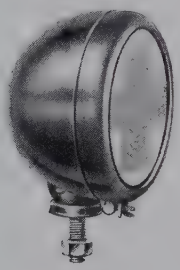




1067/1069
U.V. COCKPIT LAMP



896
AMBULANCE SEARCHLIGHT



1050
AMBULANCE LAMP



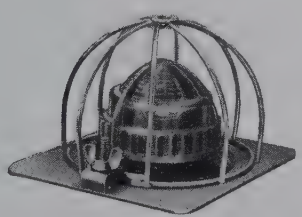
1323
ROOF WARNING LAMP
(red) for re-fuellers etc.



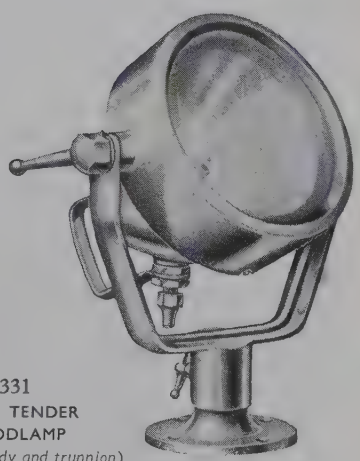
970
SWIVELLING FLOODLIGHT



1107
AIRFIELD MARKER LIGHT



1483
PROTECTOR CAGE
(for roof warning light)



1331
CRASH TENDER FLOODLAMP
(cast alloy body and trunnion)

Butlers Limited

LAMP MANUFACTURERS

ESTABLISHED 1911

Phone: VIC. 3491-2-3-4-5-6

Grams: "VANQUISHER"

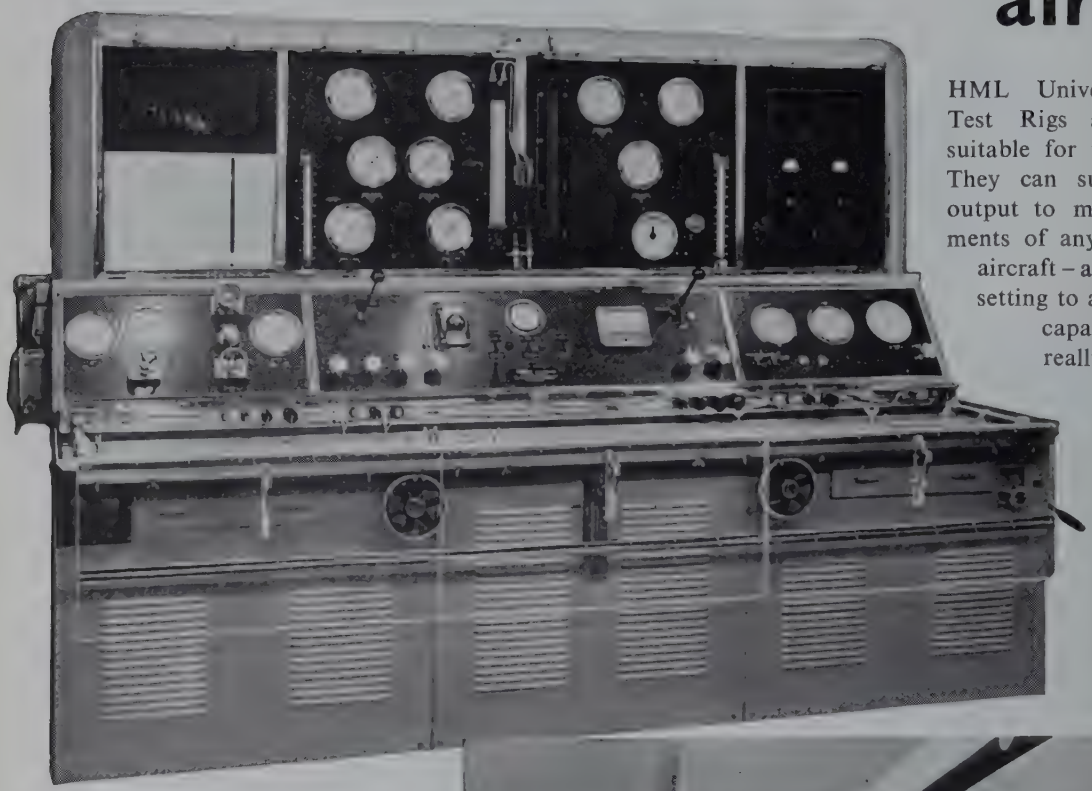
ATLANTIC WORKS, GRANGE ROAD, SMALL HEATH, BIRMINGHAM, 10

ON AIR MINISTRY, ADMIRALTY AND WAR OFFICE LISTS

Specialists in lighting equipment for all forms of transport

High-performance testing for high-performance aircraft

HML Universal Hydraulic Test Rigs are particularly suitable for modern aircraft. They can supply a precise output to meet the requirements of any of the world's aircraft – and instant presetting to any pressure and capacity makes them really UNIVERSAL.



The HML Universal Hydrostatic Test Rig provides bench testing for all hydraulic components.

HML Equipment Includes :

HML Universal Hydraulic Test Rigs Mk. II Mk. III (Diesel or Electric Powered)
HML Hydrostatic Rig (Single and Double acting)
HML Aircraft Pump and Hydraulic Motor Test Rig
HML Autostatic Hydraulic Power Pack
HML Brake Test Unit
HML Pulsometer Pump Test Unit
HML Tensioning Test Unit
HML High-speed Gear Boxes
HML High-pressure Filters
HML High-pressure Accumulators
HML Valves
HML Universal Hydraulic Tyre Remover
HML Hydraulic Propeller Test Bench



The HML Mobile Universal Hydraulic Test Rig gives operational testing on the aircraft when it is being serviced for flight.

HML (ENGINEERING) LTD. ***AIRCRAFT DIVISION***

466-490 EDGWARE ROAD, LONDON W.2. **Telephone: PADDINGTON 0022 (12 lines)**

DHB 5065

VOSPER LTD
PORTSMOUTH

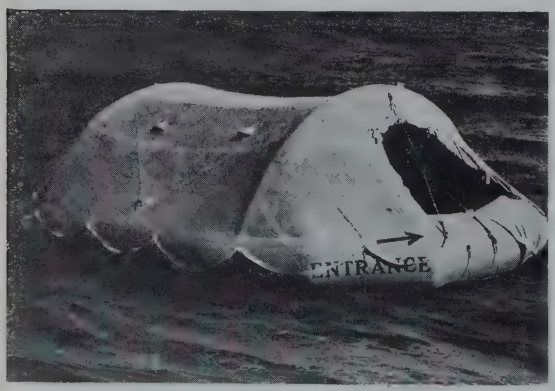




SLIDE to safety

WITH THE ELLIOT Escape Chute

Within 8 seconds of an emergency landing the Elliot Inflatable Escape Chute will provide that vital link between aircraft door and ground, a drop that can often mean broken limbs and a real danger to very young and very old people. The Elliot Escape Chute provides a cushioned slide without attendants on the ground. Available for door heights up to 20′ from the ground, fully automatic and with installation to suit existing or new aircraft.



Other inflatable life-saving equipment in the Elliot range comprises six versions of the world renowned inflatable Life-Rafts specially designed for the Aircraft industry to seat up to 20 persons.

We shall be pleased to send details or arrange demonstrations of all Elliot inflatable equipment on request.

ELLIOT EQUIPMENT LIMITED

ONE OF THE P. B. COW GROUP OF COMPANIES

Sales Office: **5 FALMOUTH ROAD, SLOUGH, BUCKS.**

TELEPHONE: SLOUGH 20262

Head Office and Works: Llwynypia, Rhondda, South Wales

On every Victor flying.....

Titanine Aircraft Finishes



A fast moving vapour trail, high above, is often all that marks the passage of the Handley Page Victor. At these great heights, flies Britain's most formidable strategic bomber, a weapon combining striking power with high performance.

TITANINE

AIRCRAFT FINISHES

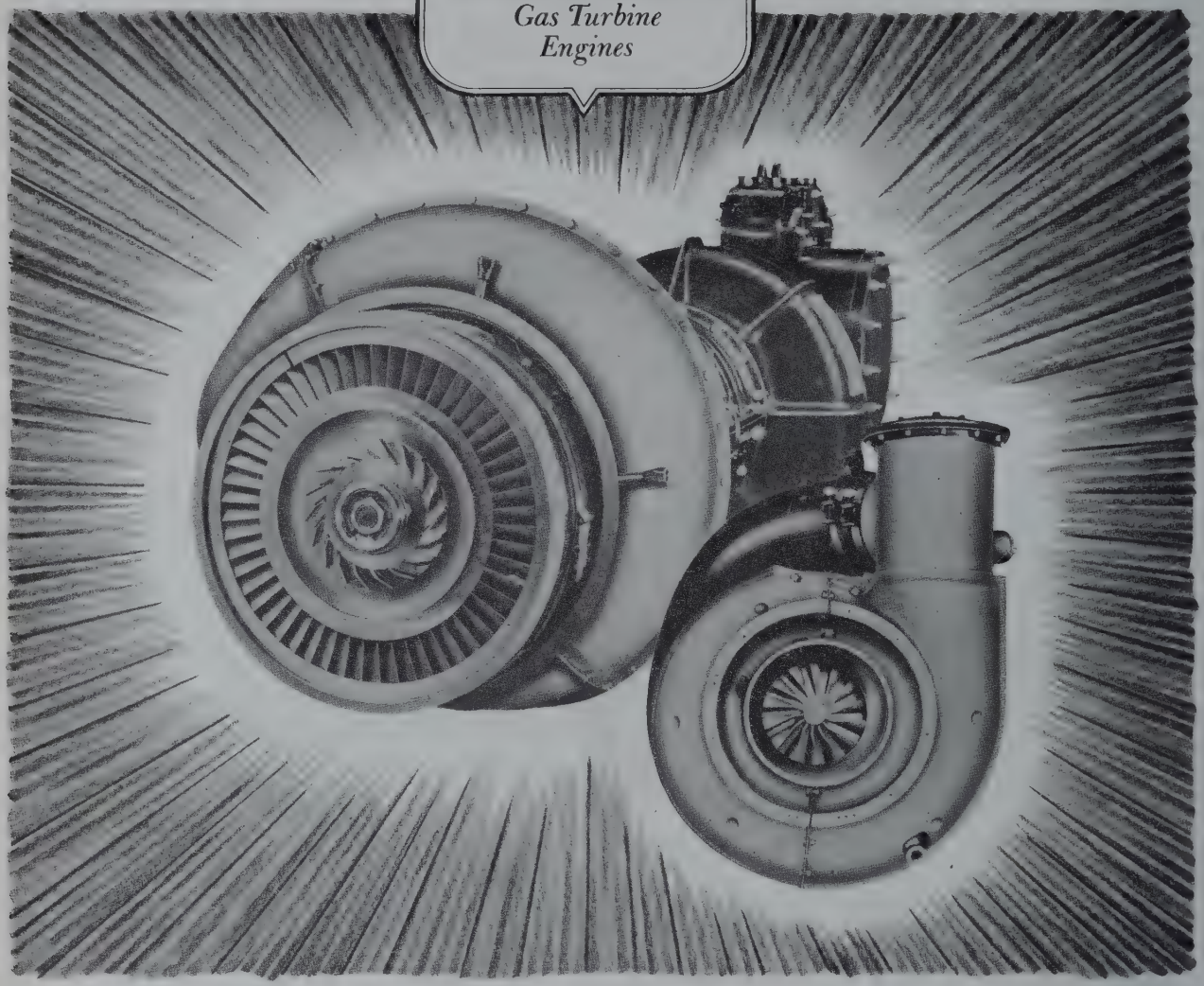
TITANINE LIMITED. COLINDALE. LONDON. N.W.9

Telephone : COLindale 8123 (6 lines).....

POWER PLANTS IN YOUR FUTURE

SOLAR MARS® AND JUPITER®

Gas Turbine Engines



Simple, reliable proven in service

MANY, VARIED USES—from marine propulsion to airborne generators and to portable fire pumps—have been perfected for these versatile Solar engines. Both the 50 hp Mars and the 500 hp Jupiter gas turbines offer a long list of advantages over conventional power plants—light weight, compactness, ease of starting, simple maintenance and operation on a variety of fuels are a few of their attributes.

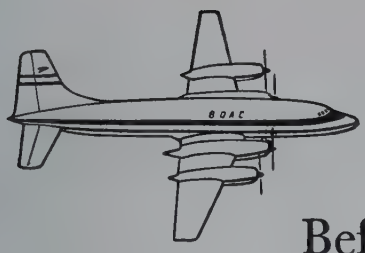
Gas turbine engines deserve a prominent place in your forward planning. From the very first units, the Mars and Jupiter engines have achieved remarkably trouble-free service records. Their rugged dependability, plus the many unusual advantages of gas turbines, are worth your investigation. Dept. Y-12, Solar Aircraft Company, 2200 Pacific Highway, San Diego 12, California.

WRITE FOR BOOKLET. New brochure describes Solar gas turbines—how they work, advantages they offer to forward-looking industries. Send for a copy.

SOLAR
AIRCRAFT COMPANY
SOLAR
SAN DIEGO DES MOINES

ENGINEERS WANTED *Unlimited opportunities, challenging projects, good living with Solar! Write for new brochure.*

DESIGNERS, DEVELOPERS AND MANUFACTURERS • GAS TURBINES • AIRCRAFT AND MISSILE COMPONENTS • BELLOWS • CONTROLS • COATINGS • METAL ALLOY PRODUCTS



Before they take the air...

Accurate refuelling and detailed inspection of every aircraft are vital for maximum safety and efficiency during flight. Aircraft refuelling now calls for highly specialised vehicles and equipment offering, amongst other things, large fuel capacity, precise metering equipment, a high rate of delivery and special safety features. It is in the design and development of this equipment that Thompson Brothers have specialised since the very early days of flying. Their equipment meets the service requirements of the latest aircraft using either overwing or pressure fuelling and includes Static Dispensers for use with Ring Mains.

THOMPSON BROTHERS (BILSTON) LTD., BRADLEY ENGINEERING WORKS, BILSTON, STAFFS.
London Office: 17 Surrey Street, Strand, London, W.C.2.



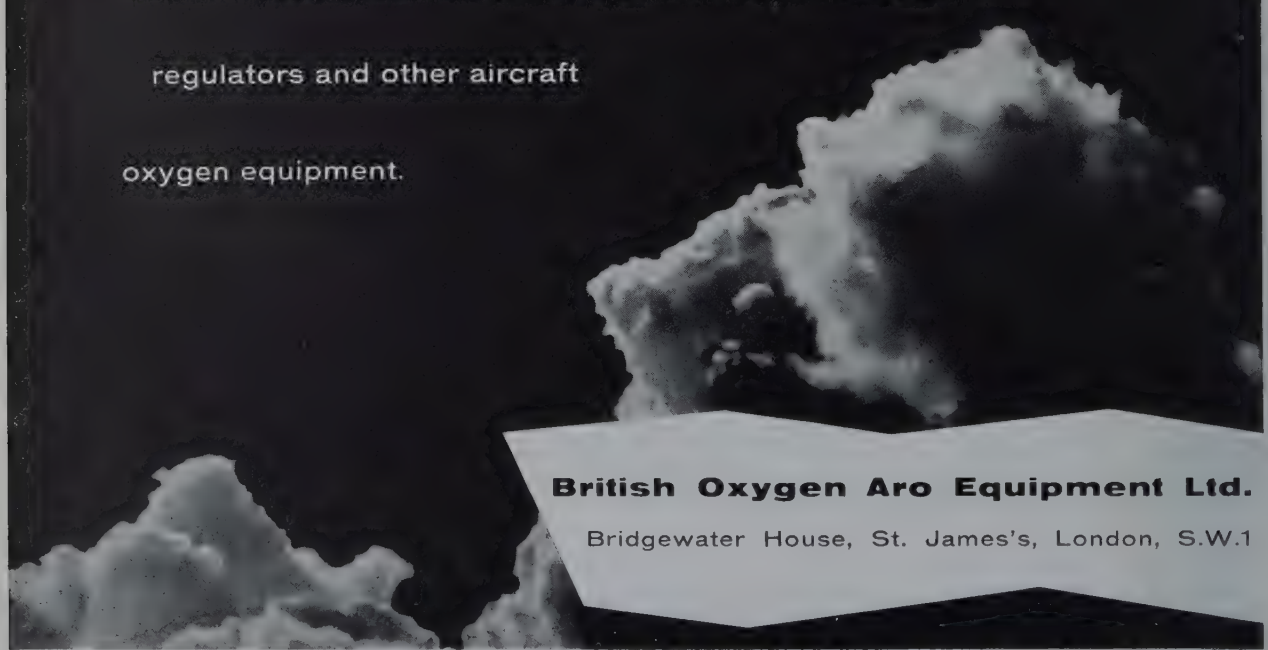
B·O·A·E –

a Service to Aviation

BRITISH OXYGEN ARO EQUIPMENT

combines the skills and experience of British Oxygen and The Aro Equipment Corporation of the U.S.A. to form an outstanding forward-looking team in the service of aviation.

B.O.A.E. specialises in liquid oxygen converters, oxygen regulators and other aircraft oxygen equipment.



British Oxygen Aro Equipment Ltd.

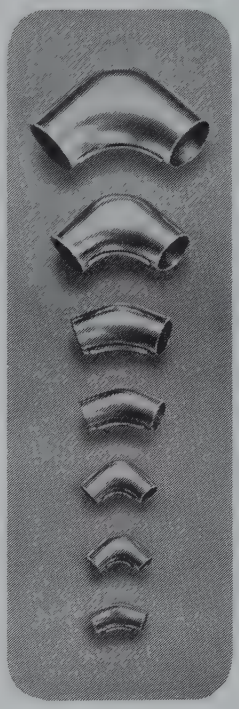
Bridgewater House, St. James's, London, S.W.1



Automatic Controls for the Branchliner

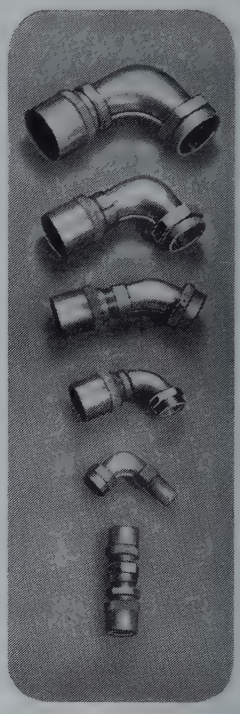
SPERRY *A.L.30 Gyropilot*

SPERRY GYROSCOPE COMPANY LIMITED . GREAT WEST ROAD . BRENTFORD . MIDDLESEX. TELEPHONE: EALing 6771



Flylite

Fuel Hose



Fire Resistant
Low Pressure Fuel
Hot Oil
with
"FLYLINK" Couplings
and
Elbows

"Flyclamp" Couplings

Designed for easy assembly—an all-metal coupling eliminating jointing material, therefore is unaffected by climatic conditions. Quick assembly—designed for easy installations in inaccessible positions. Used in conjunction with *"Flylite"* Series hose, ensures the perfect installation.



All the above Hose Assemblies approved to the Latest Specifications

ALL COUPLINGS ARE RE-USABLE—
THROUGH BORE — NO TURBULENCE

THOS. BOORN & Co. LTD.
VENN STREET, CLAPHAM, LONDON, S.W.4.

Macaulay 3060/5261/1181

at *Shorts* ideas take



shape *on* *time*

the first manufacturers of aircraft in the world

Short Brothers & Harland Ltd
Queens Island, Belfast, N. Ireland

From imagination in research,

from creative engineering in design and development,

JACK & HEINTZ *produces proved performance*

in such aircraft products as these . . .







JACK & HEINTZ Inc.
17608 Broadway • Cleveland 1, Ohio, U. S. A.

Please send immediately a free copy of your new equipment guide which tabulates 100 designs in service on aircraft, missiles and ground power units.

Name_____
(please print)

Title_____

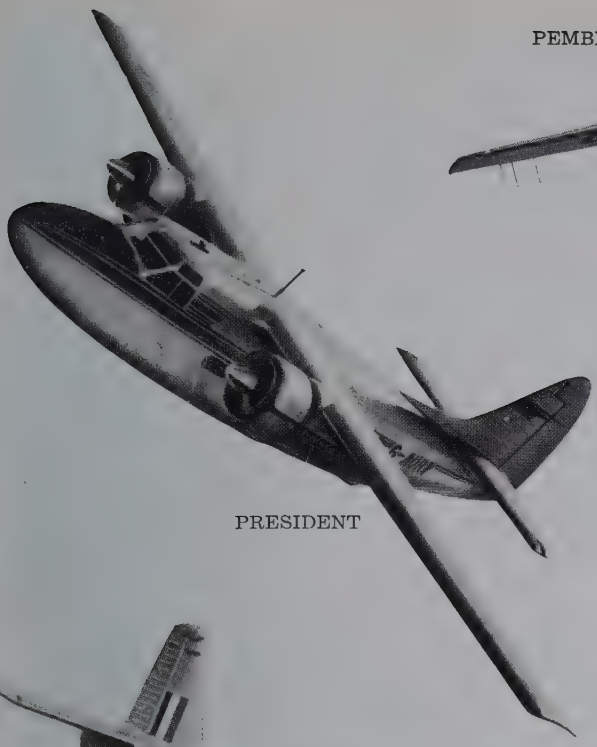
Firm Name_____

Address_____

City_____ Zone_____ State_____

PEMBROKE





PRESIDENT

Transport and Training



PROVOST

JET PROVOST



PRESIDENT

The civil counterpart of the Pembroke is normally equipped as a 12-passenger feeder liner, 6-seat executive transport or as an aerial survey aircraft. With the addition of external tanks a stage length of 1240 statute miles may be flown with full I.F.R. allowances.

PROVOST

The standard Royal Air Force ab initio/basic trainer, in service since 1953, and also selected by the Air Forces of Rhodesia, Eire, Burma and Iraq. Built in considerable numbers, both with and without armament.

PEMBROKE

The versatile general purpose military transport in service with the R.A.F., and five other overseas Air Forces. Fixed fittings, incorporated in the basic design, make it ideal for Communications (10 passengers with luggage), Casualty Evacuation (6 stretcher patients), Aerial Survey and Photography, Freighting; Twin engine Pilot Training, Navigation and Bombing Training.

JET PROVOST

The only ab initio/basic jet trainer in the world, proved and now in regular Air Force service. The Jet Provost is the ideal trainer for the all-through jet training concept.

HUNTING PERCIVAL AIRCRAFT LTD

A Hunting Group Company

LUTON, BEDFORDSHIRE, ENGLAND and at 1450, O'CONNOR DRIVE, TORONTO, CANADA



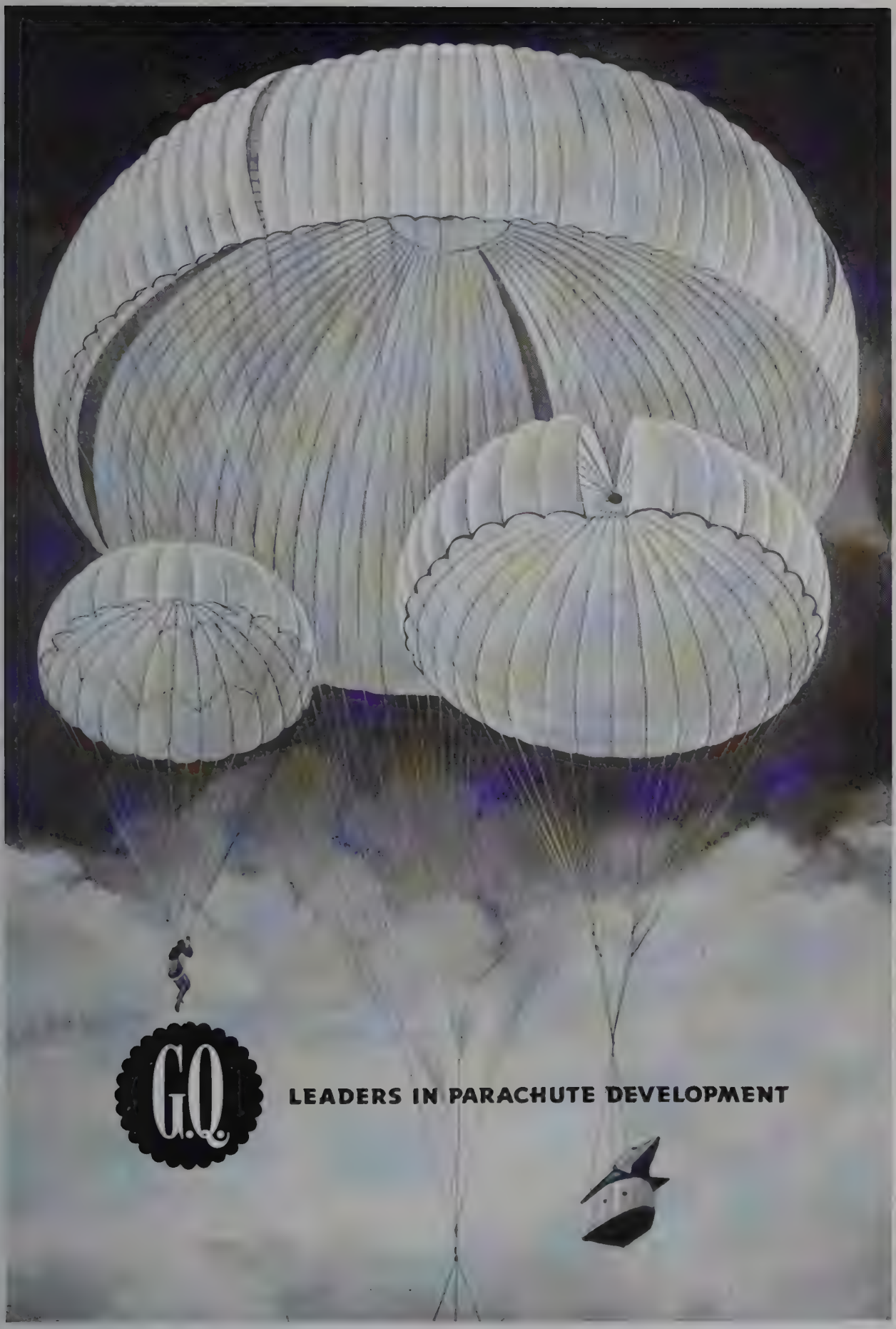
Listen, it's moving faster

He lives in a fast-moving age. Already, achievements meriting a century's span are crowded into his short lifetime. And still—as men extend their knowledge almost to the threshold of Space—the tempo quickens. Quick enough for *him* to see men's most daring ambition realised? That is still not certain. But this International Geophysical Year must bring such an achievement measurably closer.

AVIATION BP SERVICE acclaims the I.G.Y.

The BP Aviation Service is the International Aircraft fuelling organisation of The British Petroleum Company Limited

IGY I



G.Q. PARACHUTE CO LTD STADIUM WORKS WOKING · SURREY · ENGLAND · TELEPHONE: WOKING 2277

Everything points to a

CELLON

finish

Since 1911, Cellon have been producing aircraft finishes of the very highest grade, keeping abreast—and frequently ahead—of technical developments within the aircraft industry. For well over forty years, the advice of Cellon has been sought regarding a multitude of problems relating to aircraft finishing. The fact that Cellon produce to approved specifications a complete range of protective finishes for *all* civil and military aircraft is the finest tribute to the success of their activities.

The Cellon research laboratories are constantly devising new materials to match new developments in the field of aeronautics. The result is that today, everyone points to Cellon for their aircraft requirements.

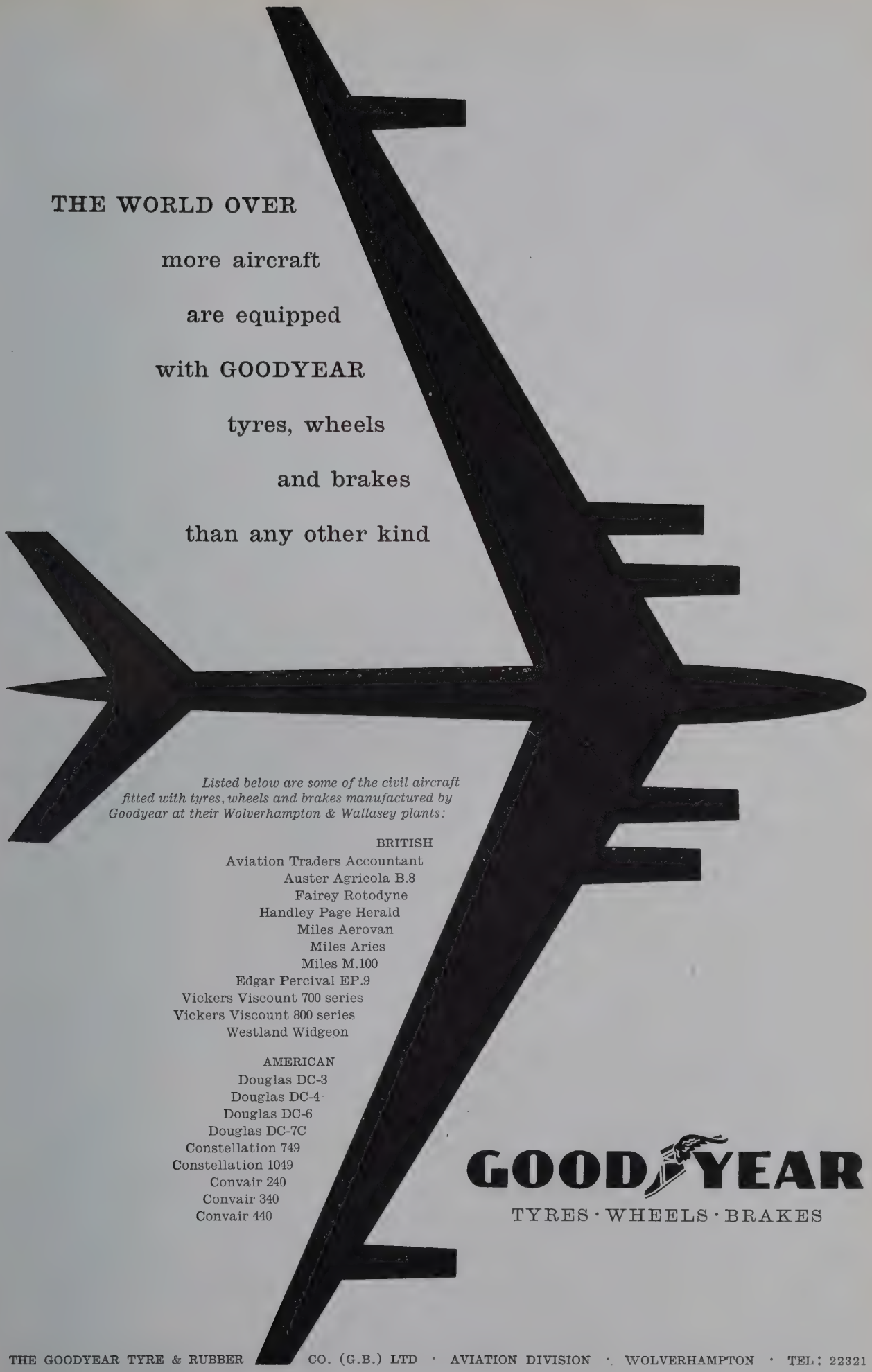
CELLON
AIRCRAFT FINISHES

CELLON LIMITED · KINGSTON-ON-THAMES · SURREY

Phone: Kingston 1234 (9 lines) *Grams: AJAWB, Phone, Kingston-on-Thames*

Also manufactured in AUSTRALIA CANADA FRANCE HOLLAND NORWAY

CVS-867



THE WORLD OVER

more aircraft

are equipped

with GOODYEAR

tyres, wheels

and brakes

than any other kind

Listed below are some of the civil aircraft fitted with tyres, wheels and brakes manufactured by Goodyear at their Wolverhampton & Wallasey plants:

BRITISH

Aviation Traders Accountant
Auster Agricola B.8
Fairey Rotodyne
Handley Page Herald
Miles Aerovan
Miles Aries
Miles M.100
Edgar Percival EP.9
Vickers Viscount 700 series
Vickers Viscount 800 series
Westland Widgeon

AMERICAN

Douglas DC-3
Douglas DC-4
Douglas DC-6
Douglas DC-7C
Constellation 749
Constellation 1049
Convair 240
Convair 340
Convair 440

GOODYEAR

TYRES · WHEELS · BRAKES

THE GOODYEAR TYRE & RUBBER CO. (G.B.) LTD · AVIATION DIVISION · WOLVERHAMPTON · TEL: 22321

THE
BRITISH AVIATION
INSURANCE COMPANY
LIMITED

The oldest and largest office specialising in Civil Aviation

at Your Service

HEAD OFFICE:

3-4 LIME STREET · · LONDON, E.C.3

TELEPHONE: MANSION HOUSE 0444 (6 lines) TELEGRAMS: AVIACOY LIME, LONDON

BRANCH OFFICES

MONTREAL
276 St. James Street West,
Telephone : Avenue 8-6135

TORONTO
44, Eglinton Avenue West,
Telephone : Mayfair 4461-4462

VANCOUVER
626 West Pender Street,
Telephone : Tatlow 2167

JOHANNESBURG
London House, Loveday Street,
Telephone : 33-3048

CALCUTTA
2 Hare Street,
Telephone: 23-3274

BRUSSELS
99 rue de la Loi,
Telephone : 12.00.05

FORGED BLADES FOR GAS TURBINES



These blades are precision forged in the new forging shop specially built and specially equipped, with the largest capacity in Europe for the production of forgings for the Aircraft Industry.

The materials forged include
STAINLESS STEELS
ALUMINIUM ALLOYS
ALUMINIUM BRONZES
NICKEL ALLOYS AND
TITANIUM ALLOYS

GARRINGTONS LIMITED, BROMSGROVE, WORCS. and DARLASTON STAFFS., ENGLAND


B
T-H
EQUIPMENT
for AIRCRAFT
Since the early days of the first World War, British Thomson-Houston has specialised in equipment for aircraft. The experience gained over many years is incorporated in the design, development, and manufacture of complete electric power systems, ignition systems, engine-starting systems, and all associated components.
BRITISH THOMSON-HOUSTON
THE BRITISH THOMSON-HOUSTON COMPANY LIMITED
COVENTRY
ENGLAND

DELTA RESEARCH
ANTI-SUBMARINE AIRCRAFT
AIR SURVEY
PLASTIC MOULDINGS
HOT-MOULDED BOATS
POWER CONTROLS



GUIDED WEAPONS
ENVELOPE TOOLING
HELICOPTERS
REPAIR AND MAINTENANCE
INVESTMENT STEEL CASTINGS

THE FAIREY AVIATION GROUP OF COMPANIES

THE FAIREY AVIATION COMPANY LIMITED
Hayes, Middlesex; White Waltham Aerodrome, Berks; Heaton Chapel, Stockport; Ringway Aerodrome, Cheshire; Heston, Middlesex; Hamble, Hants.

THE FAIREY AVIATION CO. OF CANADA LTD.
Patricia Bay Vancouver, B.C Halifax, Nova Scotia.

FAIREY AVIATION CO. OF AUSTRALASIA PTY. LTD.
Bankstown, Sydney, N.S.W., and Salisbury, South Australia.

AVIONS FAIREY S.A.
Gosselies Aerodrome, Hainaut, Belgium.

FAIREY AIR SURVEYS LTD.
24 Bruton Street, London, England, and at White Waltham Aerodrome.

AIR SURVEY CO. OF RHODESIA LTD.
Salisbury.

AERO SURVEYS LTD.
(Affiliated with Fairchild Aerial Surveys Inc.) Vancouver, B.C.

AIR SURVEY CO. OF PAKISTAN LTD.
Karachi.

AIR SURVEY CO. OF INDIA PTE. LTD.
(Associated Company) Calcutta.

FAIREY MARINE LTD.
Hamble, Hants.

AEROPLASTICS LTD.
Hillington, Glasgow.

Bryans Aeroquipment present their latest aids to

TEMPERATURE CALIBRATION AND TACHOMETER TESTING



The JETCAL

CATALOGUE No. 1632

Functionally tests the E.G.T. thermocouple circuit of a jet aircraft or pilotless missile for error, without running the engine or disconnecting any wiring.



The MOBILE TACHOMETER TESTER

CATALOGUE No. 1684

Functionally tests Tachometer and associated leads *in situ* up to an indicated speed of 24,000 R.P.M.

BRYANS AEROQUIPMENT LIMITED

WILLOW LANE, MITCHAM JUNCTION, SURREY. Telephone: MITcham 5134 (5 lines)

High Performance Service & Civil Aircraft

—

Electro-hydraulic Power Systems

—

High Fidelity Power Controls for Aircraft

—

Power Operated Gun Mountings

—

Electrical and Electronic Measuring and Calculating Instruments

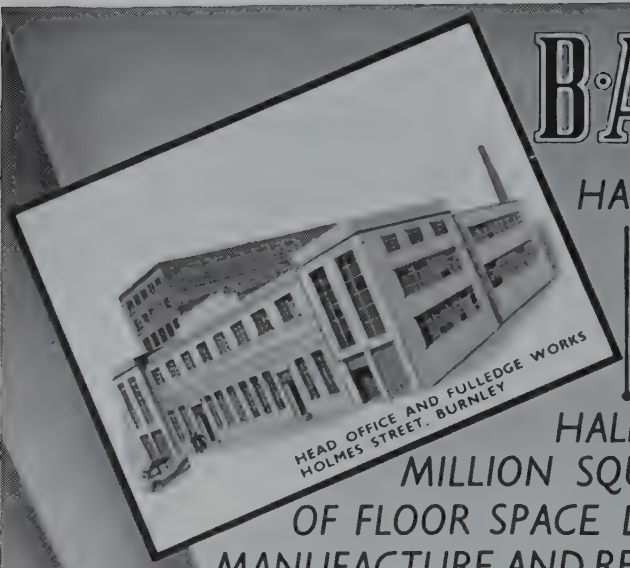
BOULTON PAUL AIRCRAFT LTD.

BPA

WOLVERHAMPTON

B·A·P

HAVE



HEAD OFFICE AND FULLEDGE WORKS
HOLMES STREET, BURNLEY

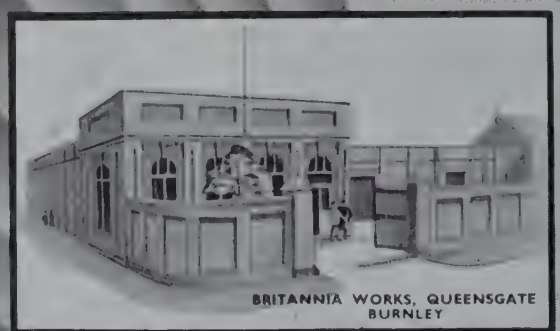


REPAIR DIVISION
STONEYHOLME WORKS
GROSVENOR ST. BURNLEY

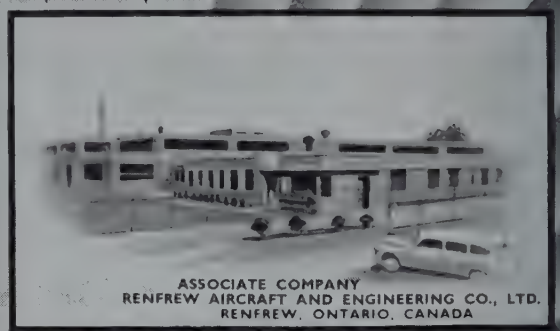
HALF A
MILLION SQUARE FEET
OF FLOOR SPACE DEVOTED TO THE
MANUFACTURE AND REPAIR OF SHEET-METAL
FABRICATIONS OF AIRCRAFT COMPONENTS
AND FOR ALL FORMS OF COMBUSTION
EQUIPMENT IN HEAT-RESISTING ALLOYS
TO THE GAS TURBINE ENGINE
AIRCRAFT INDUSTRY.

The normal run of Components comprise—
JET PIPES - EXHAUST UNITS - AIR INTAKES - FLAME TUBES - VAPOUR PIPES - DISCHARGE NOZZLE BOX PANELS - COMBUSTION CHAMBER SHROUDS - INLET BRANCH EXTENSION UNITS - FIREWALL BULKHEAD PANELS - OIL OR DRAIN TANKS - EXPANSION BELLOWS - INSULATION BLANKETS AND CASINGS ETC.,

A portion of the factory is devoted to development work. This section, which is self contained and staffed by skilled craftsmen, specialises in making by hand prototypes for test purposes and operates as it were, some weeks or months in advance of tool produced components.



BRITANNIA WORKS, QUEENSGATE
BURNLEY



ASSOCIATE COMPANY
RENFREW AIRCRAFT AND ENGINEERING CO., LTD.
RENFREW, ONTARIO, CANADA

A.I.D.
and A.R.B. approved.

BURNLEY AIRCRAFT PRODUCTS LIMITED

FULLEDGE WORKS — BURNLEY — LANCASHIRE — ENGLAND

Telephone: 3121/2 and 3203 Burnley (3 lines) Telegrams: "AIRCRAFT" Burnley

REPAIR DIVISION: GROSVENOR STREET, STONEYHOLME, BURNLEY. Telephone: 3184

BRITANNIA WORKS, QUEENSGATE, BURNLEY. Telephone: 4102

Associated with

RENFREW AIRCRAFT & ENGINEERING CO. LTD., RENFREW, ONTARIO, CANADA

Blackburn

Manufacturers of
High-Speed Strike Aircraft —
Transport Aircraft —
Gas Turbines
and Piston Engines

BLACKBURN AND GENERAL AIRCRAFT LIMITED

BROUGH · EAST YORKS · ENGLAND

A93/

66 adv.

FERRANTI

GYRO HORIZONS

FOR RELIABILITY AND ACCURACY



The Ferranti FH5 Mark 4 Artificial Horizon (illustrated above) is specified for use in high speed jet aircraft in service at the present time.

THESE INSTRUMENTS USE THE "PITCH-BANK" METHOD OF CONTROL RESULTING IN THE HIGHEST POSSIBLE ACCURACY

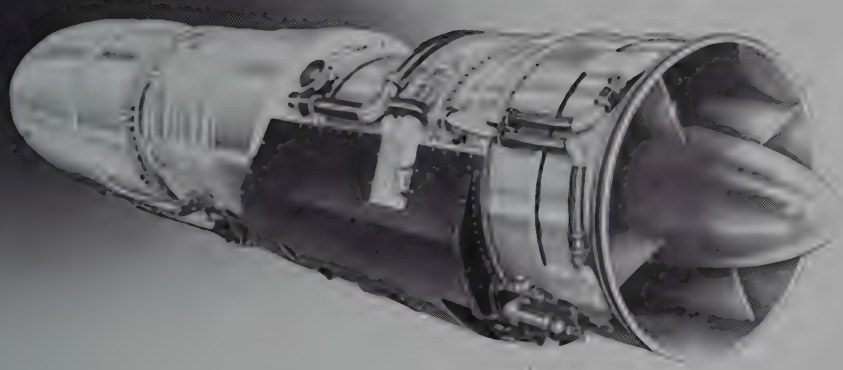
write for full information to :-

FERRANTI LTD., AIRCRAFT EQUIPMENT DEPT., MOSTON, MANCHESTER 10
or WESTWICK, BRACKNELL, BERKSHIRE

FI 158

ORENDAS...

IN OPERATIONAL SERVICE ON FOUR CONTINENTS



For a well-defended future . . . **IROQUOIS,** *Orenda's supersonic design.*

ORENDA ENGINES LIMITED
MALTON, CANADA
MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP



Habershon Steel has a hand in most modern aircraft

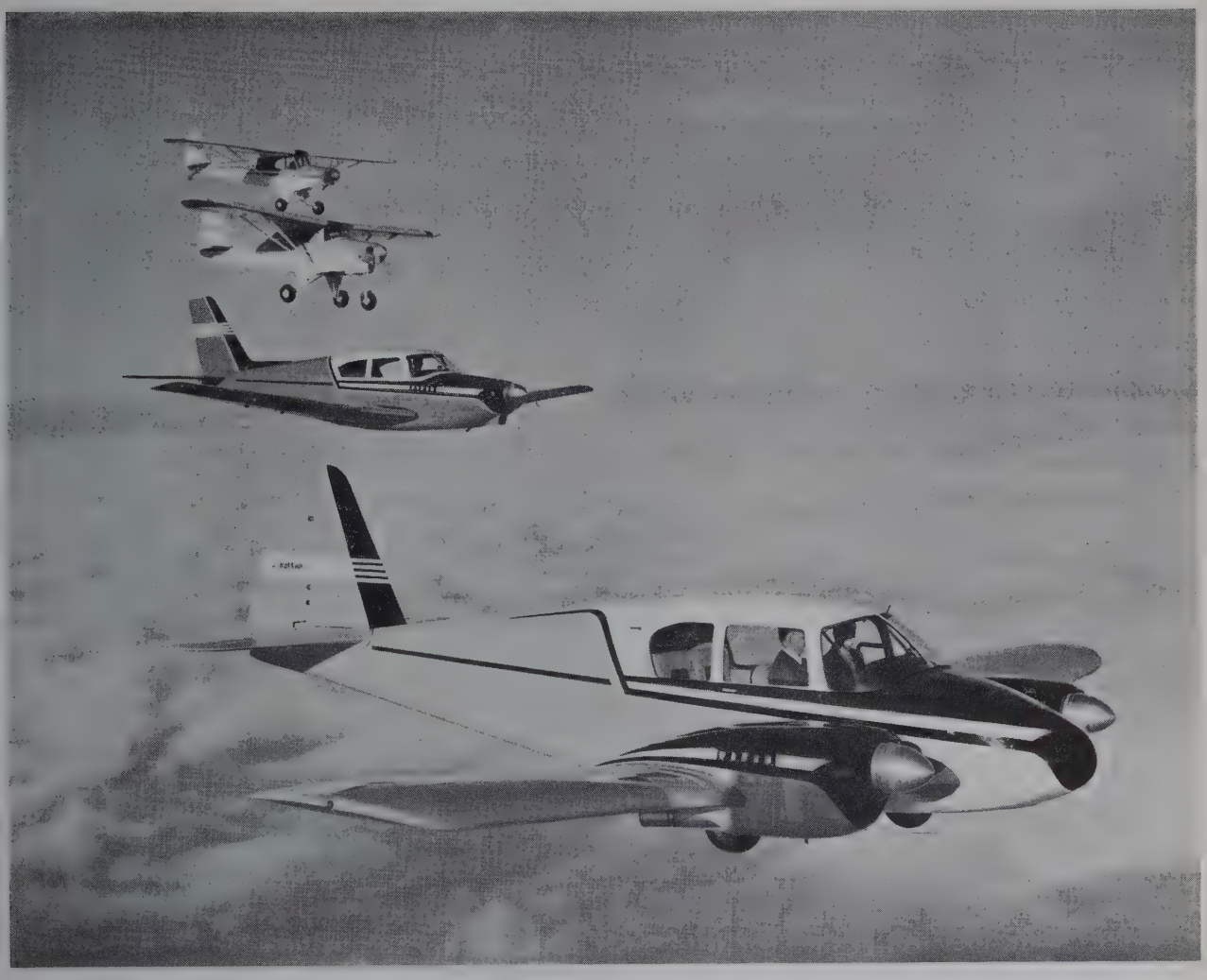
Steel strip and sheets are really essential materials in aircraft manufacture, and probably the most famous name in this connection is Habershon.
Produced to the highest standards of precision, Habershon steel is backed by more than a century's manufacturing experience.
That is why these first-class products are in constant demand throughout the aircraft industry.

Habershon STEEL STRIP & SHEETS

mean quality in quantity

J. J. Habershon & Sons Ltd., Holmes Mills, Rotherham. Tel.: 2081 (6 lines)

OA 4102



PIPER

BUILDS THE WORLD'S MOST WIDELY PURCHASED AIRCRAFT

More Piper airplanes have been built and sold for business and private use than any other aircraft in the world.

The Piper organization has built more than 44,000 aircraft in the past 29 years. This preference for Piper can be attributed to rugged design, excellent flight characteristics, and ideal suitability for the job at hand.

This year Piper offers four superb aircraft—each designed to fill a specific requirement. For general utility training, liaison, and agricultural flying, the 150 horsepower Super Cub (top) has sensational performance and load carrying ability. The Piper Tri-Pacer (second from top) is the most popular four-passenger business airplane of its class, with simplified controls and over 130 m.p.h. cruising speed. The sleek Piper Comanche provides exceptional roominess for four people with very high performance. The Piper Apache is by far the widest selling multi-engine airplane in the world. Production on this four or five-place executive transport equals that of all other American twins combined.

You'll find a Piper plane ideally suited for practically every purpose. Literature gladly sent on request.

PIPER

AIRCRAFT CORPORATION

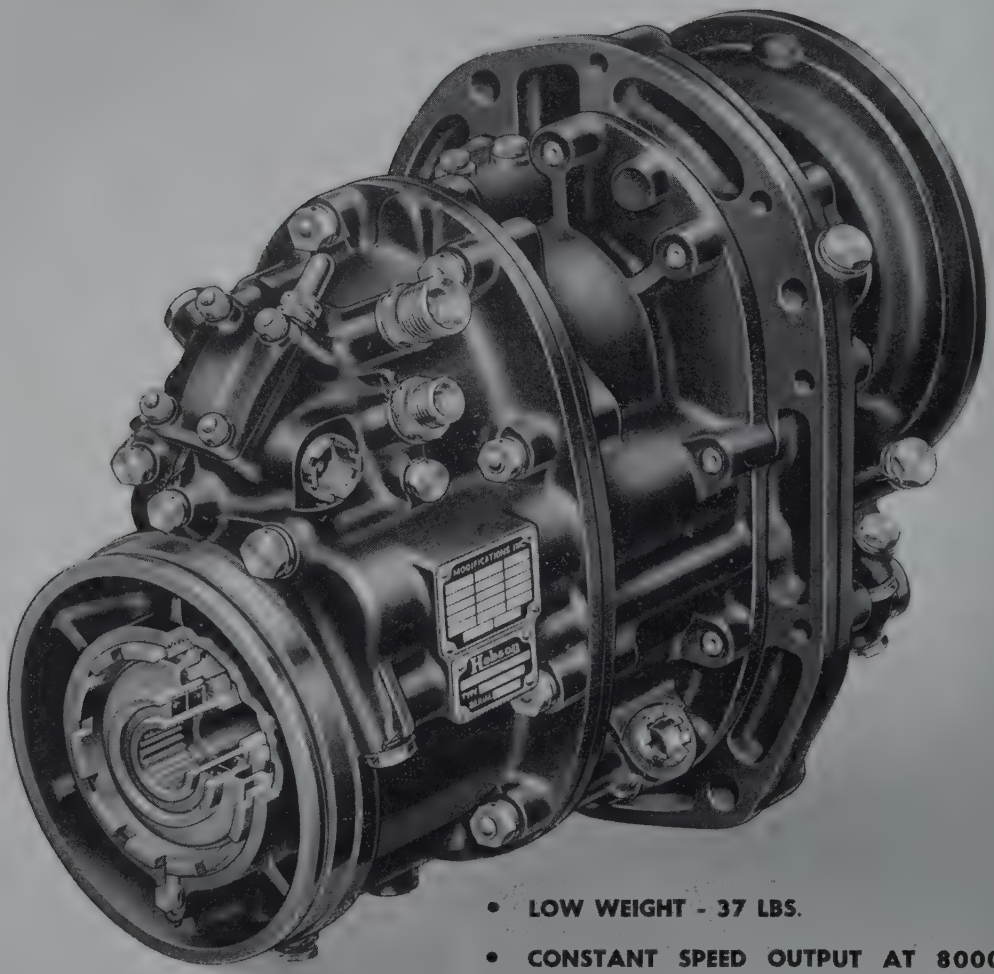
Lock Haven, Pennsylvania

MORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

The Hobson

Constant Speed

ALTERNATOR DRIVE UNIT



- **LOW WEIGHT - 37 LBS.**
- **CONSTANT SPEED OUTPUT AT 8000 R.P.M. FOR 10 K.V.A. ALTERNATOR OVER FULL 3 - 1 INPUT SPEED RANGE.**

H. M. Hobson Limited have, over the past 40 years, been engaged in the design and manufacture of precision engineering components for aircraft, aero-engines and, more recently, atomic reactor control systems.

H. M. HOBSON LIMITED · WOLVERHAMPTON · ENGLAND

Agencies Overseas

UNITED STATES OF AMERICA
SIMMONDS AEROCESSORIES, Inc.,
Tarrytown, New York, U.S.A.

SPAIN
SEÑOR RAMON ESCARIO,
Nunez de Balboa 29, Madrid.

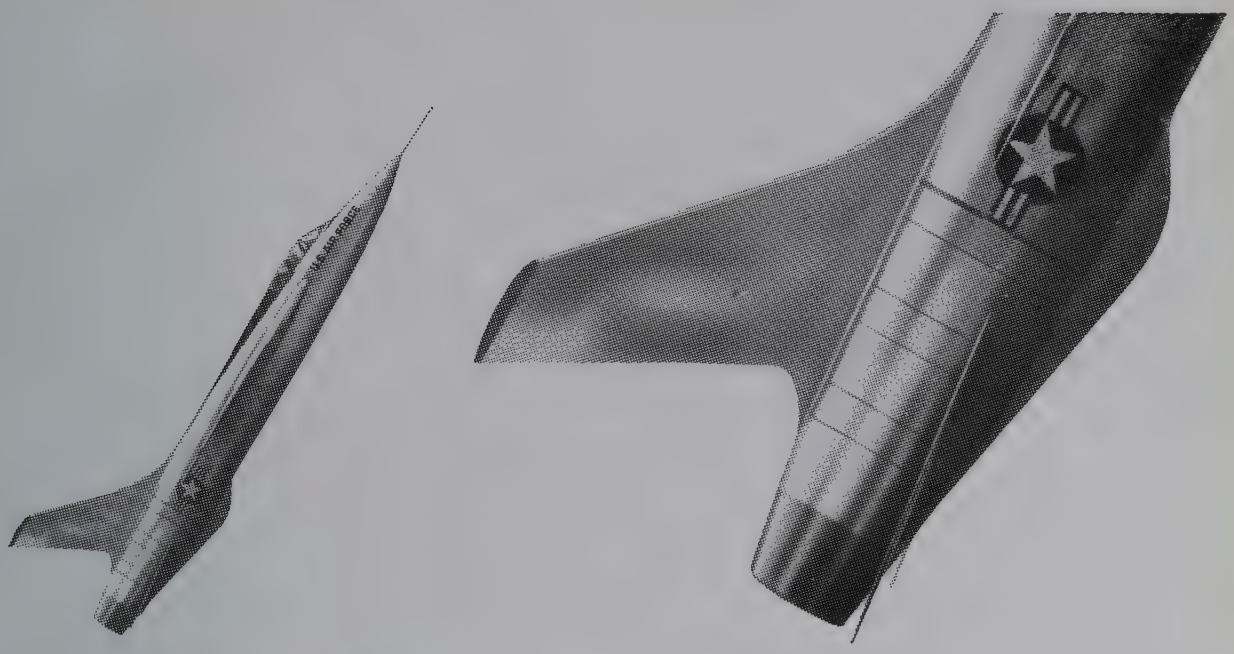
FRANCE
SOCIÉTÉ COMMERCIALE ET INDUSTRIELLE FRANCO-BRITANNIQUE,
48 Avenue Raymond Poincaré,
Paris, XVI^e.

AUSTRALIA
AERONAUTICAL SUPPLY
Co. Pty. Ltd., 210 Victoria Street,
Melbourne, Victoria.

ITALY
SECONDO MONA, Somma Lombardo.

ISRAEL
CURT ISRAEL, P.O.B. 3133, Tel Aviv.

EGYPT, SYRIA, IRAQ AND LEBANON
T. G. MAPPLEBECK,
P.O.B. 2712, 175 Daoud Pacha Street,
Zokak El-Blatt, Beirut, Lebanon.



NOW YOU SEE IT · · NOW YOU DON'T



THE F-105

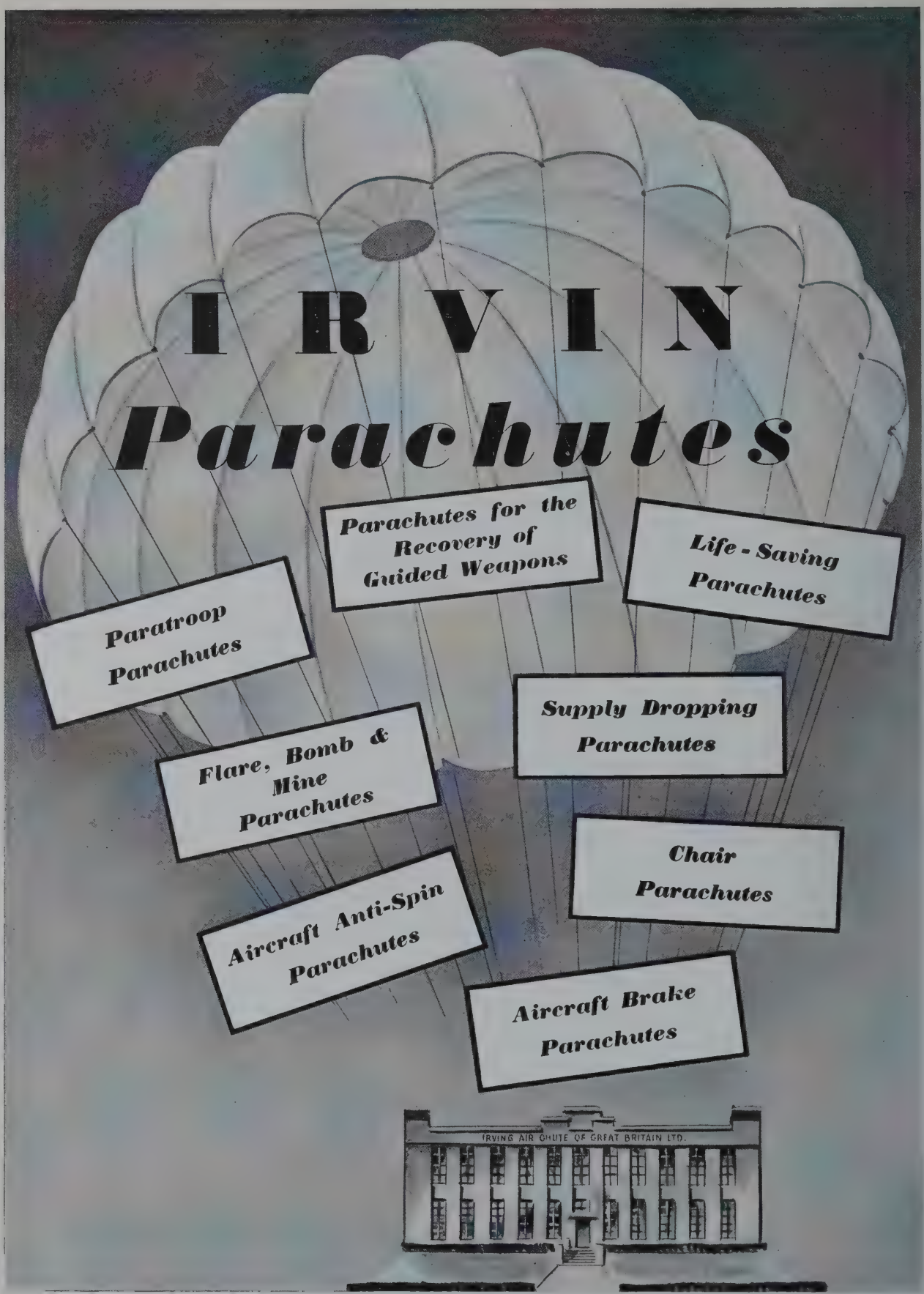
Furious speed . . . smashing primal power . . . overwhelming persuader for peace, this new Thundercraft, more than any other . . . is designed to deliver Tactical Air Command's composite air strikeforce knockout punch at any target, any time!*

Latest in the line . . . The* ***THUNDERCHIEF*

REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, N. Y.

Designers and Builders of the Incomparable ***THUNDER-CRAFT***



The Irving Air Chute of Great Britain Ltd.

LETCHWORTH . HERTS . ENGLAND

Telephone: Letchworth 888

Telegrams: Irvin, Letchworth

le NORATLAS

EST PRODUIT EN GRANDE SÉRIE



par la SNCAN

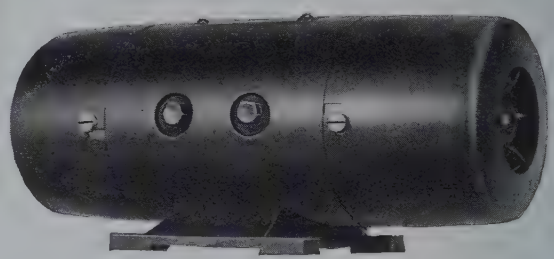
2 A 18, RUE BÉRANGER - CHATILLON S/S BAGNEUX - SEINE - TÉL. ALÉ. 57-40

74 adv.



AUTOMATIC
VOLTAGE REGULATORS
The illustration shows a Type 34 Control Box which includes an automatic voltage regulator.

NEWTON-DERBY AIRCRAFT ELECTRICAL EQUIPMENT



ROTARY TRANSFORMER FRAME D.2.2.
Up to 100 watts output. Weight 5⅞ lbs.

Many other sizes available

WE SPECIALISE in the design and manufacture of Lightweight Electrical Equipment for Aircraft.

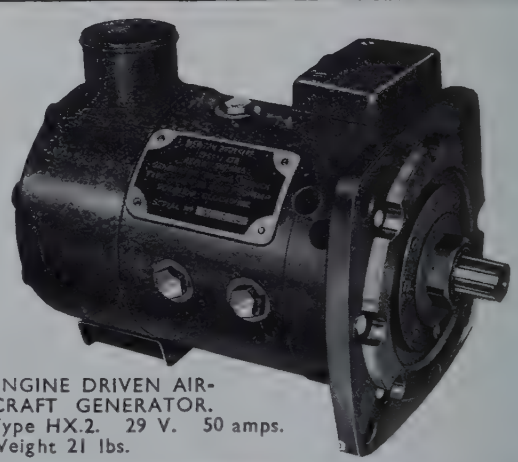
Our products include:-

NEWTON-DERBY PATENT AUTOMATIC CARBON PILE VOLTAGE AND CURRENT REGULATORS for use with aircraft generators and electrical circuits where controlled voltage or current is required.

ROTARY TRANSFORMERS AND CONVERTERS. A.C. AND D.C. ENGINE AND WIND DRIVEN LIGHTWEIGHT AIRCRAFT GENERATORS FOR Radar, Wireless, Battery charging, etc.

FRACTIONAL H.P. LIGHTWEIGHT AIRCRAFT MOTORS.

HIGH FREQUENCY ALTERNATORS



ENGINE DRIVEN AIRCRAFT GENERATOR.
Type HX.2. 29 V. 50 amps.
Weight 21 lbs.

Under A.I.D. and A.R.B. approved inspection and design schemes.

NEWTON BROTHERS (DERBY) LTD.

HEAD OFFICE & WORKS: ALFRETON RD., DERBY. PHONE: DERBY 47676 (4 LINES). GRAMS: DYNAMO, DERBY
LONDON OFFICE: IMPERIAL BUILDINGS, 56 KINGSWAY, W.C.2. TEL: 0623 HOLBORN



SPEED

CARAVELLE, medium-range transport, puts the power of its two jet engines within the reach of medium-haul passengers. Speed is no longer the privilege of long-range intercontinental transport.

The simplicity of the aircraft's design reduces technical requirements and ground service to a minimum. Its high rate of climb enables the CARAVELLE to reach its cruising altitude within a few minutes ; descending from 20,000 feet to ground level in three minutes, it retains its speed of *500 m.p.h.* to the end of the trip.

SILENCE

CARAVELLE, like all jet-propelled aircraft, is free of vibrations. Furthermore, owing to the aft location of the jet pods, passengers enjoy complete silence.

More noiseless than the most luxurious automobile, the CARAVELLE'S cabin confirms the success of our engineers. Sound level : *82 decibels.*

COMFORT

CARAVELLE is not only quieter and faster, but also more comfortable. The same restful atmosphere prevails throughout the CARAVELLE'S cabin, from the first row of seats to the last. *No bad seats.*

ECONOMY

CARAVELLE is a better money-maker than any other commercial aircraft even on such short runs as Paris to London.

It is a MEDIUM-RANGE transport which does only this job but does it well. Operators appreciate its advantages which ensure great passenger appeal.

Not an "all-purpose" carrier, not "speed at any price." A compromise formula : *speed that pays.*

SUD-AVIATION

Head Office: 37, Bd de Montmorency, Paris

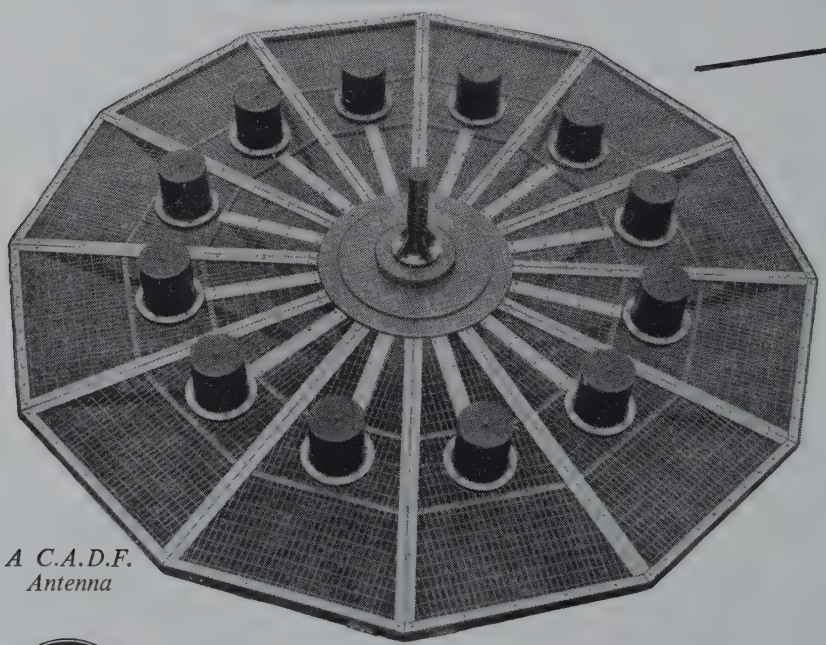
NEW YORK
500, Fifth Avenue

C.A.D.F.

COMMUTATED ANTENNA DIRECTION FINDING

An entirely revolutionary method of RADIO DIRECTION FINDING. The most notable advance in Direction Finding since the introduction of the Adcock aerial in 1916.

Another advance by *Standard*



A C.A.D.F. Antenna

Applicable to the H.F., V.H.F. and U.H.F. bands.

- **Major reduction of site errors, up to ten times better than a conventional Adcock system.**
- **Interference eliminated by "capture effect".**

Engineered for land or ship-borne use.

Standard Telephones and Cables Limited

Registered Office : Connaught House, Aldwych, London, W.C.2

RADIO DIVISION: OAKLEIGH ROAD · NEW SOUTHGATE · LONDON N.11

Under the Colombo Plan





THE HT-2

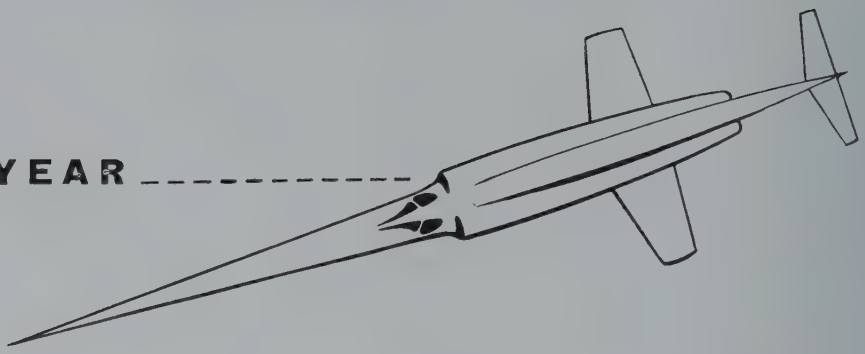
FOR TRAINING OF PILOTS IN SINGAPORE

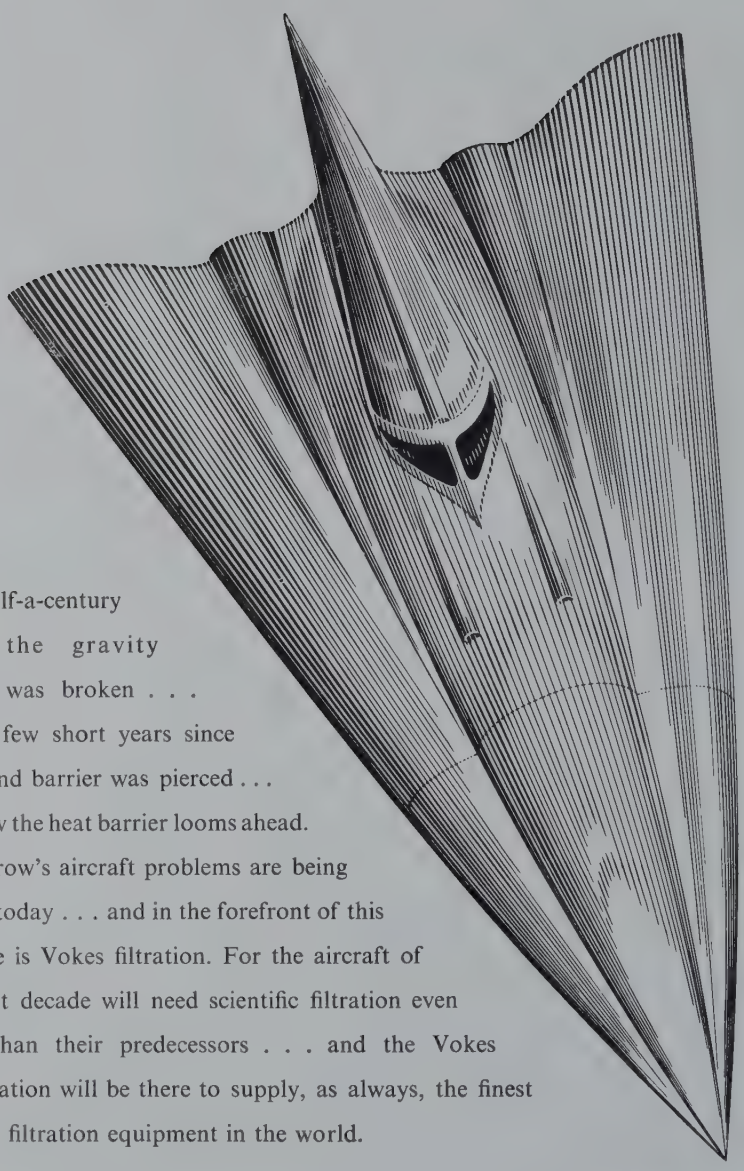
HINDUSTAN AIRCRAFT (PRIVATE) LTD.
BANGALORE INDIA.



THIS YEAR

NEXT YEAR





Tomorrow's aircraft, too, will benefit from VOKES FILTRATION

Only half-a-century since the gravity barrier was broken . . . only a few short years since the sound barrier was pierced . . . and now the heat barrier looms ahead. Tomorrow's aircraft problems are being solved today . . . and in the forefront of this advance is Vokes filtration. For the aircraft of the next decade will need scientific filtration even more than their predecessors . . . and the Vokes organisation will be there to supply, as always, the finest aircraft filtration equipment in the world.

VOKES

Pioneers of Scientific Filtration

VOKES LIMITED · GUILDFORD · SURREY · London Office: 123 Victoria Street, Westminster, S.W.1

VOKES (CANADA) LTD. TORONTO *Represented throughout the world* VOKES AUSTRALIA PTY. LTD. SYDNEY

V209A

easy handling...



AT AIRPORT

FOKKER F-27 Friendship

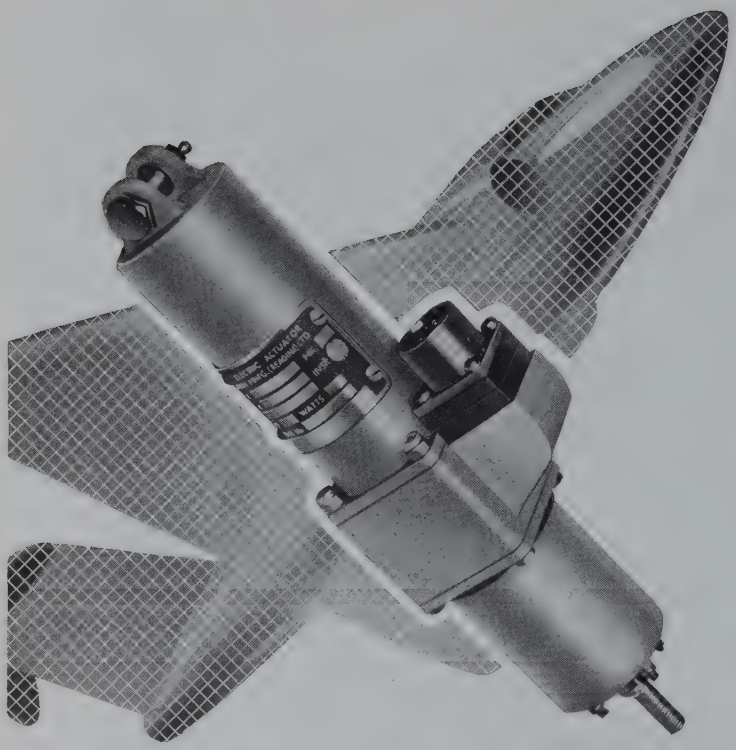
ROLLS-ROYCE „DART" POWERED AIRLINER

- ★ truck level loading because of low floor and inward sliding, self-sealing cargo door
- ★ only a small step is needed for passengers boarding aircraft
- ★ speedy early morning departures because no warming up of turboprop engines is required

Friendships on order by: AER LINGUS – TRANS-AUSTRALIA AIRLINES – DEPARTMENT OF CIVIL AVIATION/AUSTRALIA – NETHERLANDS GOVERNMENT – R.I.V./FIAT – BRAATHENS – K.L.M. – MACKEY AIRLINES – WEST COAST AIRLINES – FRONTIER AIRLINES – BONANZA AIRLINES – PIEDMONT AIRLINES – QUEBEC AIR – AEROVIAS EQUATORIANAS – GENERAL TIRE & RUBBER COMP. – CONTINENTAL CAN COMP.

Fokker

SAFETY — COMFORT — ECONOMY



. . . quality and endurance

. . . above all . . .

are characteristic of all aviation accessories bearing the trade mark of Western Manufacturing (Reading) Ltd. Foremost amongst the problems solved by us are those dealing with remote control. Western's Electric Actuators are relied upon by many leading Aircraft Constructors.

WESTERN MANUFACTURING (Reading) LTD.

THE AERODROME · READING · BERKSHIRE

Telephone: SONNING 2351 Grams: HAWK, READING *EJ100 Mk 20*

When there's something in the air . . .

MARSTON DEVELOPMENTS

are playing their part in Britain's Leading Aircraft

with Heat Exchangers, 'Flexelite' flexible fuel tanks
Laminated plastic Radomes and other components

The Marston design and development organisation is approved by the Ministry of Supply and the Air Registration Board — can we help to solve *your* problem?

MARSTON EXCELSIOR LIMITED,
FORDHOUSES, WOLVERHAMPTON
Tel : Fordhouses 2181

(A subsidiary company of Imperial Chemical Industries Ltd.)

MAR.147



VTOL ...new dimensions of FLIGHT

BELL Aircraft corp.
BUFFALO N.Y.

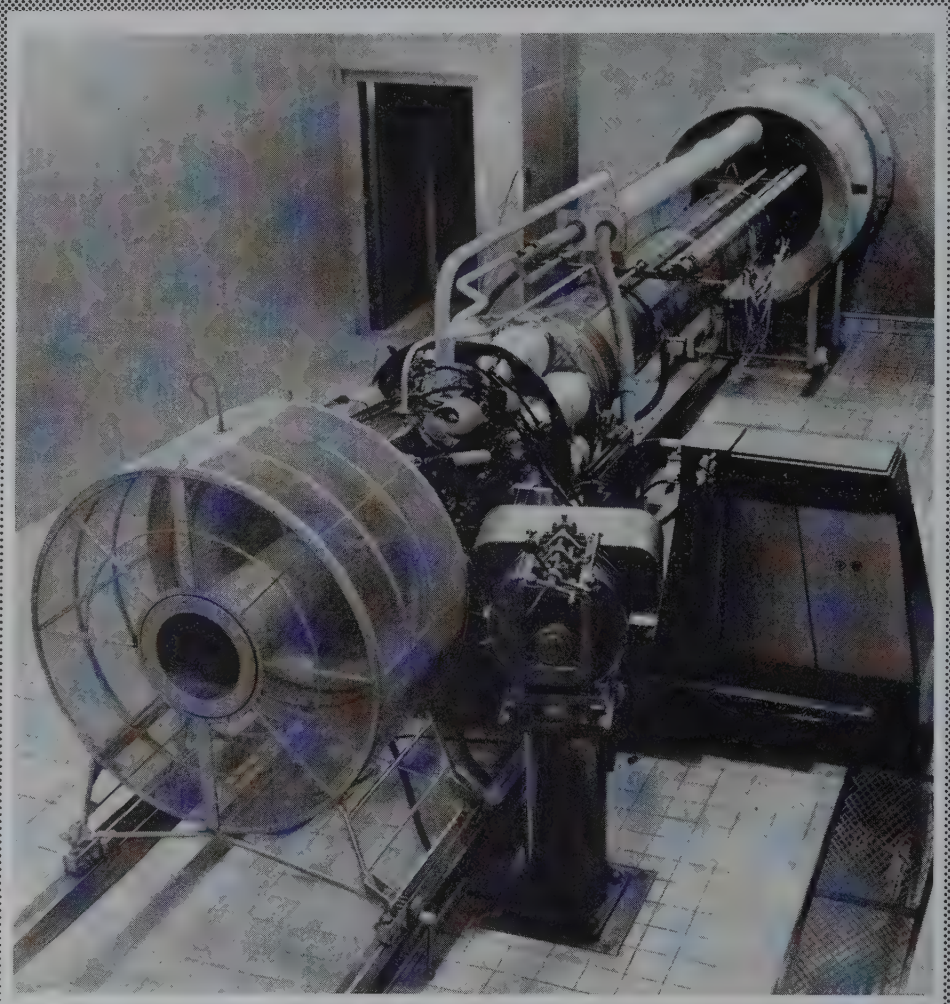
BELL AIRCRAFT has kept pace with the need for greater operational mobility and flexibility in both military and commercial aviation by developing four basic types of VTOL (vertical-take-off-and-landing) aircraft.

Studies and development work on a ducted propeller prototype have advanced to a point where this new design concept is fast approaching reality at Bell. The X-14 uses new principles of jet propulsion to take off and land vertically with the airframe in a normal horizontal position. The XV-3 convertiplane takes off like a helicopter, but as its rotors tip forward in flight, it becomes a normal, fixed wing aircraft. The XH-40 turbine-powered helicopter has substantially increased speed and payload and the ability to use a wide range of fuels.

The skillful and imaginative type of research which was the forerunner of these projects is being carried steadily forward at Bell Aircraft in the interest of still further scientific advancements in the commercial and military aircraft of tomorrow.

RESEARCH, DEVELOPMENT and PRODUCTION IN THE FIELDS OF: Guided Missiles • Research Aircraft • Servomechanisms • Electronics • Rocket Engines • Electronic Control Devices • Vertical Rising Aircraft

CURRAN



Typical Overseas Turbo - Jet Test Installation
depicting High Degree of Engine Accessibility

TEST EQUIPMENT

- FOR ALL TYPES OF AERO ENGINES -

Series 'J' Test Stands
for Performance Testing
Turbo-Jet Aero Engines
up to **30,000** lbs. Thrust
Also available in mobile version

Series 'T'
Torque Measuring Test Stands
for Performance Testing
Turbo-Prop Aero Engines
up to **10,000** h.p.

JOHN CURRAN LTD. · *Mechanical Engineers* · CURRAN ROAD, CARDIFF, 'Phone 20641



AVIONS HUREL-DUBOIS

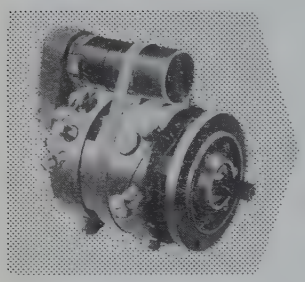
ROUTE DE VERRIÈRES A MEUDON, VILLACOUBLAY - FRANCE
BOITE POSTALE N° 6 A MEUDON - TEL. : OBS. 27-90

20 years experience of aircraft hydraulics

INTEGRAL

HYDRAULIC PUMPS & MOTORS

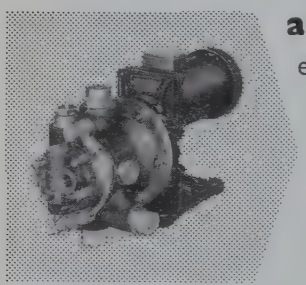
for



general services

pump **180** Mk. 43

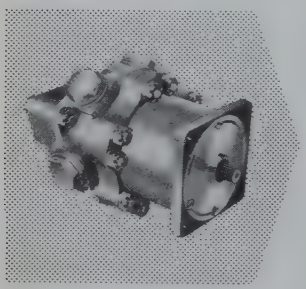
Engine-driven pumps for operation at pressures up to 4000 p.s.i.; deliveries up to 30 g.p.m. Special features include automatic constant-pressure control and high-pressure ripple elimination.



ancillary equipment

electric motor- pump unit **216** Mk.1

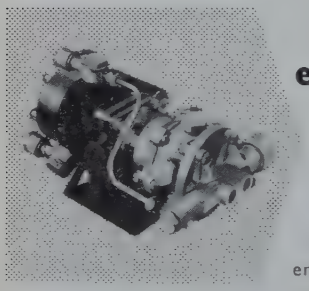
Electric motor-driven pump units for pressures up to 4000 p.s.i.; deliveries up to 9 g.p.m. For auto-pilots, propeller feathering, hydro-mechanical clutches for helicopter rotors, etc.



powered flying controls

motor **199** Mk. 6

Engine and electrically driven pumps to supply the power. Motors to convert the hydraulic power to useful work at the control unit, with torque outputs up to 36 lb. ft.



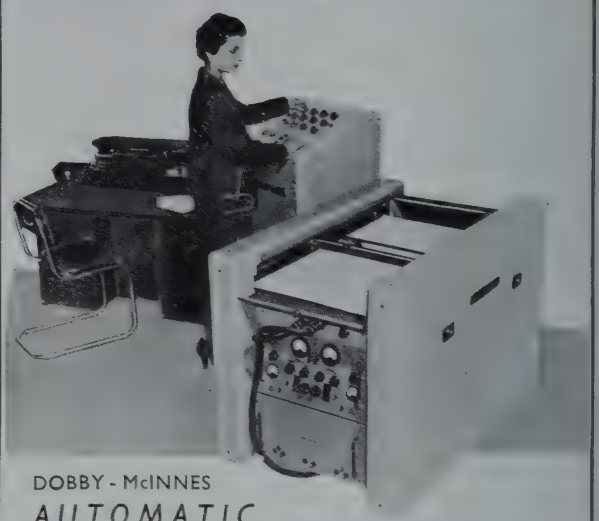
emergency systems

hydraulic motor-pump unit **215** Mk. 2

Special-purpose units to meet particular requirements. Unit illustrated gives an independent emergency supply at high pressure and is operated from a system at a lower pressure.

Integral Limited, Birmingham Rd., Wolverhampton
Tel. Wolverhampton 24984

DATA REDUCTION



DOBBY - McINNES
AUTOMATIC

GRAPH PLOTTER

of PUNCHED CARDS
PUNCHED TAPE
or KEYBOARD

DOBBIE McINNES LTD.

BROOMLOAN ROAD, GLASGOW, S.W.1., SCOTLAND
Phone: GOVan 2394 Grams: "COMPASS" Glasgow

MILLS' SAFETY BELT

LAP TYPE—ME/1789

APPROVED BY AIR REGISTRATION BOARD
(Ref. No. E.3053)

A new design of Passenger Seat Belt which complies with the latest specification requirements.

Webbing dyed to suit aircraft colour scheme.

SAFETY HARNESSES FOR PILOTS

Approved Types for all Aircraft

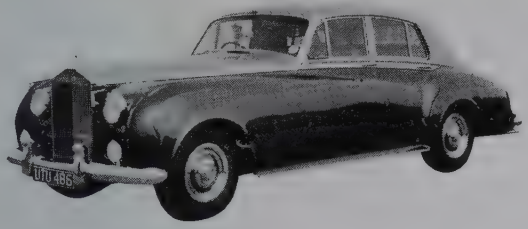
Details and prices upon application to:—

THE MILLS EQUIPMENT CO., LTD.,

56, VICTORIA STREET, WESTMINSTER,

LONDON, S.W. 1.

Telephone: VICTORIA 9271-2-3 (Ext. No. 13)
Telegrams: EFFIGIES, PHONE, LONDON.



Suppliers to

ROLLS-ROYCE

The Best Car in the World

Y E S

EATONIA

BEARINGS & BUSHES

YORKSHIRE ENGINEERING SUPPLIES LIMITED
"EATONIA" BRONZE FOUNDRIES, LEEDS 12

Telephone: Leeds 638234/638291 Telegrams: Yes, Leeds 12

DRAGONAIR

OIL FIRED

AIR HEATING EQUIPMENT

A.I.D. AND A.R.B. APPROVED

STATIC AND MOBILE HEATING UNITS

FOR

CABIN WARMING AND ANTI-ICING IN FLIGHT

CABIN AND ENGINE PRE-WARMING AND GENERAL AERODROME USE

HANGAR HEATING AND DRYING

Consult—

DRAGONAIR LIMITED

FITZHERBERT ROAD, FARLINGTON, HANTS.

Telephone:
Cosham 76451-2-3

SBAC

Telegrams:
Evarges, Portsmouth



angular motion faithfully transmitted

M E Light Series Universal Joints are available in special design for aircraft use, made in light alloy to Spec. L.40 anodised, with hardened ground steel trunnion pins, cadmium plated. They are designed with shank diameters to suit bore of standard aircraft tube and will withstand moderate tension or compression loads. Made in a wide range of sizes, they can be supplied with covers as required.

M E Patent Universal Ball Joint has recently been designed for 40% increased load carrying capacity for the same weight.

Hooke's Type Universal Ball Joint is suitable for high rotational speed and end loading.

M E Grease Retaining covers are available for all types and sizes of joints.



Air Ministry Test House Authority 89755/31

THE MOLLART ENGINEERING CO. LTD.

KINGSTON-BY-PASS · SURBITON · SURREY · ENGLAND

Telephone: ELMBRIDGE 0033-7 (3 lines) *Telegrams:* PRECISION, SURBITON

ANGLO AMERICAN Aviation Company

EXPORT SPECIALISTS

U.S. STATE DEPT. Registration 4240

We supply :

PRATT & WHITNEY AND WRIGHT ENGINE PARTS

DOUGLAS, NORTH AMERICAN AND OTHER AIRFRAME PARTS

ENGINE, AND AIRCRAFT ACCESSORIES

ENGINE, FLIGHT AND AIRCRAFT INSTRUMENTS

HYDRAULIC PUMPS, MAGNETOS, CARBURETORS AND PROPELLORS AND PARTS

WHEELS AND BRAKES, TUBES, TYRES

A-N HARDWARE AND RAW MATERIAL

CONTROL CABLES AND HOSE GASKETS, BEARINGS, LORD MOUNTS AND RUBBER MATERIAL

RADIO, ELECTRONICS AND ELECRICAL MATERIAL

TOOLS, SHOP AND TESTING EQUIPMENT

MISCELLANEOUS AIRCRAFT MATERIAL

Speedy delivery
Competitively Priced

Please send your enquiries to :—

ANGLO AMERICAN AVIATION COMPANY

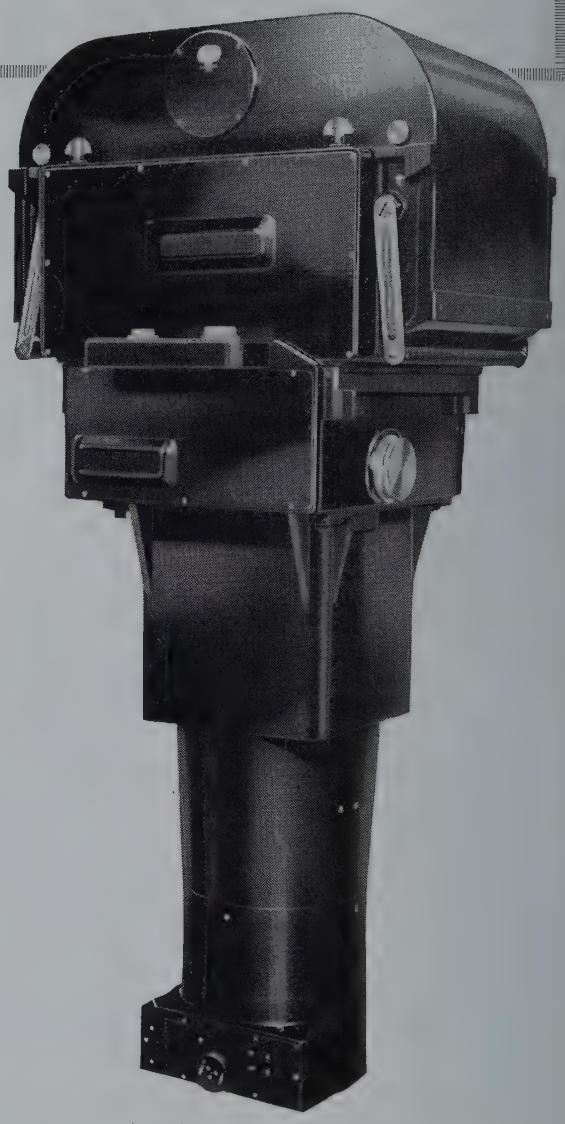
P.O. BOX 13
BURBANK, CALIFORNIA

Phone .. .. .. **Victoria 9-3304**
Cable .. .. .. **AMTRADE**

or to our Representative for the U.K. and the Continent:

Captain H. W. R. BANTING
Anglo-American Aviation (Spares) Ltd.
163 NEW BOND STREET, LONDON W1, England

F96



The finest air reconnaissance camera available today

for details please write to :

WILLIAMSON

MANUFACTURING COMPANY LTD.

Photographic Engineers

Litchfield Gardens, Willesden Green, London, N.W.10

WM26A(R)

Everything under control



There are few Companies with such varied experience as "Brown's"—designers of the only entirely British gyro compass, first manufacturers in the world of a master reference gyro for Aircraft, and famous in the past for our founder, Mr. S. G. Brown's inventive genius which, for example, made possible the transmission of submarine telegraphy over long distances. Today our unique experience is applied in producing many things, including Guided missile control equipment, High speed recording cameras, Torpedo and radar control gyroscopes, Aircraft pressurised inter-communication amplifiers, Miniature motors and tacho generators, the well-known "Subsig" Echo Sounders and, of course, Brown headphones and telephones. We also cut gears to better than Admiralty Class I specification. Manufactured to the standard of precision that is our hallmark, these "Brown" Products can fairly be described as without equal.

Brown THE PRECISION PEOPLE

S. G. BROWN LTD., SHAKESPEARE STREET, WATFORD, HERTS.
Incorporating The Submarine Signal Co. (London) Ltd.
Telephone: Watford 7241. Grams: "Sidbrownix Watford"

Celebrating . . .

The 60th birthday of

JANE'S FIGHTING SHIPS

For 60 years the developments of the world's navies has been recorded in the successive editions of this famous annual. This latest edition dated

1957-58

Edited by
R. V. B. Blackman, A.M.I.N.A., A I.Mar.E.

has a new look—a changed shape, and a new form of presentation to make reference easier and quicker.

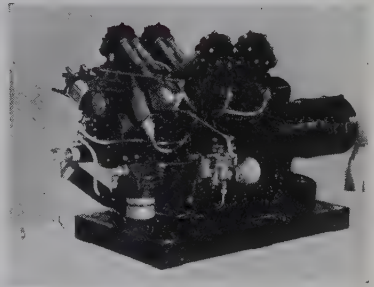
Jane's Fighting Ships is obtainable through the same sources as *Jane's All The World's Aircraft.* See page 6 adv.

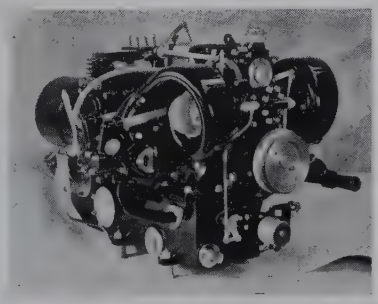
ABC

Airborne Auxiliary Power Plants

Designed and produced for the Ministry of Supply

15 H.P. Power Unit driving 6 KW – 28 Volt D.C. Generator for installation in the "Beverley" aircraft and similar duties.





The 5 H.P. Power Unit driving through clutch and gearbox.

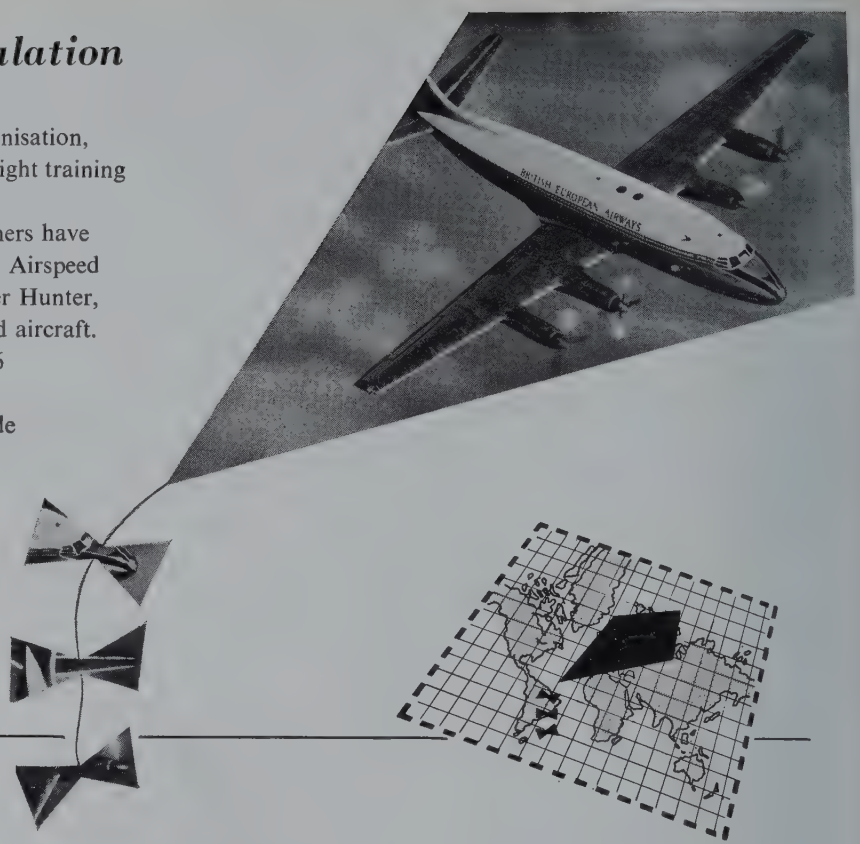
1. Dynamo=25 amps at 12 volts.
2. Petrol Pump 2,500 galls per hour.
3. Bilge Pump 2,500 galls per hour.
4. 2 Compressors–charging 400 cub. ins. to 200 lbs. per sq. in. in 2½ mins.

For installation in "Sunderland" and other Flying Boats.

A.B.C. MOTORS Ltd.
Walton-on-Thames, Surrey, England
Phone - 774/775 Grams' - "Revs"

Safety through Simulation

Backed by a world-wide servicing organisation, Air Trainers Link Ltd. have synthetic flight training equipment in most parts of the world. Electronic Simulators and 'Type' Trainers have been ordered for the Vickers Viscount, Airspeed Ambassador, Bristol Britannia, Hawker Hunter, Gloster Meteor and yet more advanced aircraft. No less than 20 Civil Operators and 16 Air Forces have selected these or General Purpose Trainers from the wide range of equipment manufactured by Air Trainers Link Limited.



AIR TRAINERS LINK LIMITED
AYLESBURY BUCKS

Multi-channel automatic recording systems

The Mastertape specially developed for multi-channel recording systems is the only tape available with high polish on the recording surface, background noise being practically non-existent.

Enquiries to :

MSS RECORDING COMPANY LIMITED

COLNBROOK · BUCKINGHAMSHIRE



The MSS Company are the originators of the Mastersound system recognised throughout the world as the most accurate method of sound recording. Used by the Admiralty, General Post Office, Ministry of Supply, the B.B.C., and musicians and technicians everywhere

A.C. or D.C.? You choose— we supply

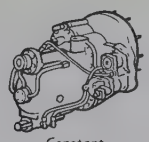
English Electric Aircraft Equipment Division are at the hub of a revolution now going on in aircraft electric systems — the switch from D.C. to constant frequency A.C.

English Electric D.C. equipment — generators, invertors, motors, actuators — have logged thousands of hours flying experience in both military and civil aircraft.

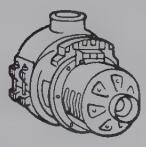
On the A.C. side we are uniquely placed — not only because we are licensed to manufacture the well proved Sundstrand Constant Speed Alternator Drive Unit, but also because we have behind us an organisation unrivalled in the country for its experience with complete A.C. power systems.

The new English Electric Test and Development Laboratories at Bradford are among the finest of their type in the country. They have been established to further our activities in the testing of equipment under simulated high altitudes and extremes of temperature and climatic conditions.

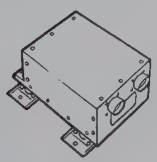
Whatever your aircraft electrical problems, large or small, A.C. or D.C., we have knowledge and experience that will be of value to you. May we help you?



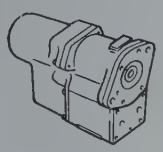
Constant Speed Drives



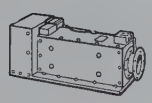
Alternators



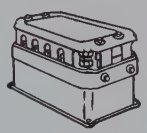
Alternator Control Panels



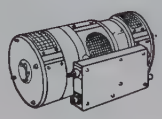
Rotary Actuators



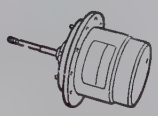
Transformer Rectifier Units



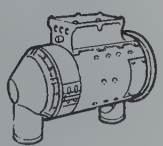
Circuit Breakers



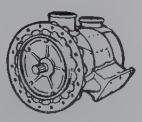
Invertors



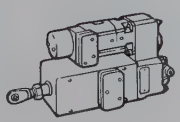
Pump Motors



Starter Generators



Generators



Linear Actuators

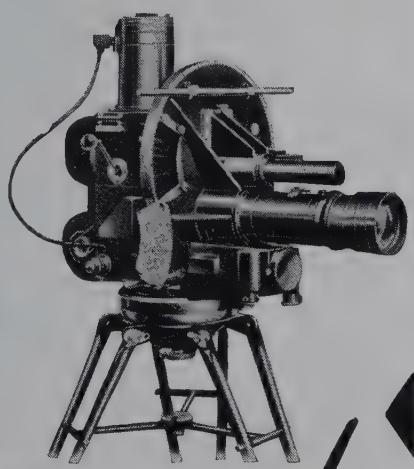
'ENGLISH ELECTRIC' aircraft equipment

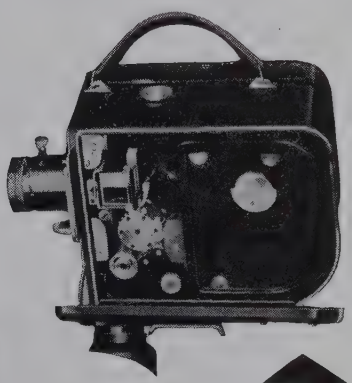
THE 'ENGLISH' ELECTRIC COMPANY LIMITED · **AIRCRAFT EQUIPMENT DIVISION** · PHOENIX WORKS · BRADFORD

FLIGHT TEST EQUIPMENT

HIGH SPEED CINEMATOGRAPHY

For the analysis of high-speed phenomena. This camera is used extensively on guided weapon research and will provide film speeds of up to 275 cine-frames per second.



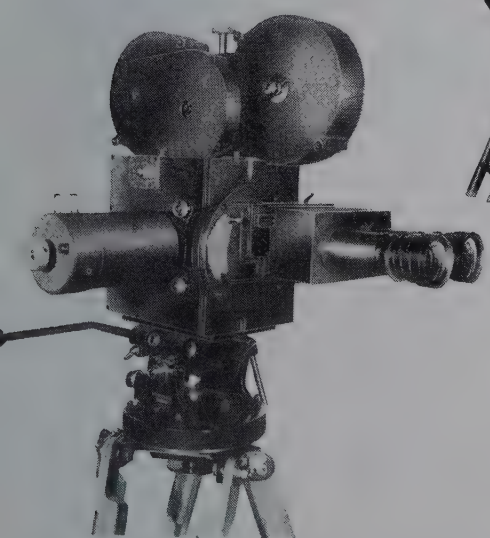


INSTRUMENT OBSERVATION

A light instrumentation camera giving permanent records on 35 mm. film of all instrument panel readings during flight. Fully automatic, compact dimensions.

TAKE-OFF AND LANDING DATA

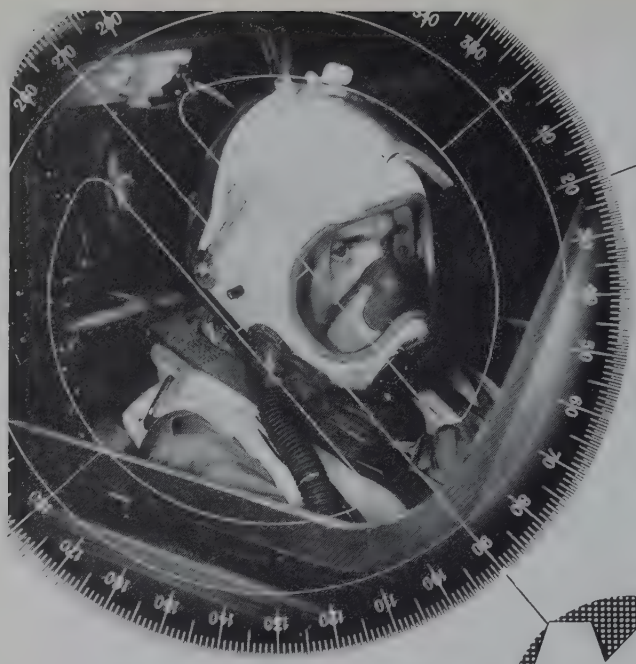
For the evaluation of aircraft performance on Take-off and Landing. The production of accurate and permanent records for Distance/Time and Distance/Height curves. Ground Speed. Rate of Climb, Take-off and Landing Speeds, Acceleration, etc.



Vinten

V. VINTEN LTD., NORTH CIRCULAR ROAD, CRICKLEWOOD, LONDON, N.W.2. Tel. GLADSTONE 6373

Sole Exporting Agents:—Cinematograph Export Ltd., North Circular Road, London, N.W.2.



– EVERY ANGLE OF AIRCRAFT DESIGN ...

GUIDED TARGET AIRCRAFT
LIGHT AIRCRAFT
PRESSURISED HELMETS
SPECIALISED GROUND EQUIPMENT
AUTO PILOTS
ELECTRICAL TEST EQUIPMENT
MOBILE AIR CONDITIONING UNITS
MOBILE PRESSURE TESTING UNITS
ARMAMENTS

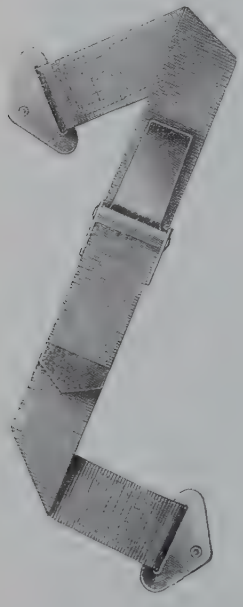
ML AVIATION COMPANY LTD

WHITE WALTHAM AERODROME, MAIDENHEAD, BERKS.

Telephone: LITTLEWICK GREEN 248. *Telegrams: 'EMELAIR' WHITE WALTHAM.*

From take-off to touch-down . . .





SAFER...
with SIEBE, GORMAN

OXYGEN APPARATUS

is one of the many major contributions made by Siebe, Gorman to safer flying. Their aircraft oxygen equipment includes a full range of emergency apparatus, regulators, economisers, liquid oxygen convertors, cylinders, fittings and test equipment.

SAFETY BELTS, HARNESS, LIFE BELTS

Typical of the efficiency of this equipment is the Siebe, Gorman Aircraft Safety Belt Type IV. Here, fixing and adjustment are completed in one operation, and a definite lift of the lever gives instant release. Belts of this type—approved by the Air Registration Board—have been supplied to the leading Airlines.

DECOMPRESSION CHAMBERS FIRE FIGHTING EQUIPMENT

Contractors to Admiralty, Ministry of Supply etc.,

Established 1819

SIEBE, GORMAN & CO., LTD.
LONDON
EVERYTHING FOR SAFETY EVERYWHERE

NEPTUNE WORKS, DAVIS RD., CHESSINGTON, SURREY

Telegrams: Siebe, Chessington. *Telephone: Elmbridge 5900*

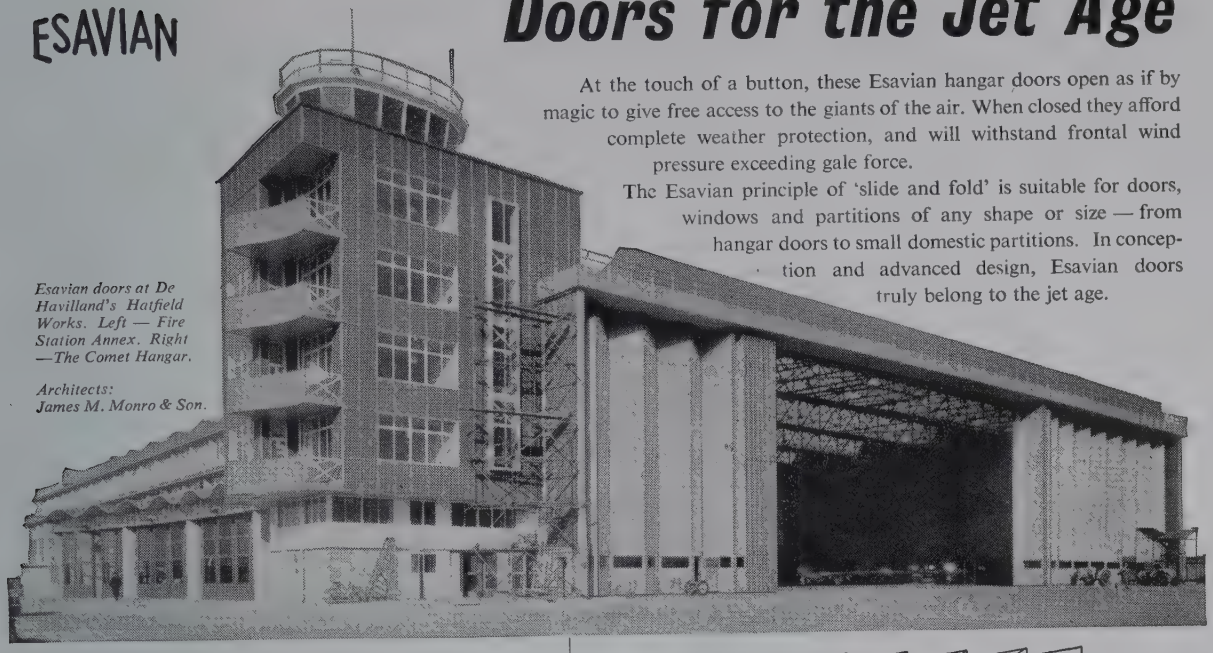
S.G (A)4

ESAVIAN

Doors for the Jet Age

At the touch of a button, these Esavian hangar doors open as if by magic to give free access to the giants of the air. When closed they afford complete weather protection, and will withstand frontal wind pressure exceeding gale force.

The Esavian principle of 'slide and fold' is suitable for doors, windows and partitions of any shape or size — from hangar doors to small domestic partitions. In conception and advanced design, Esavian doors truly belong to the jet age.



Esavian doors at De Havilland's Hatfield Works. Left — Fire Station Annex. Right —The Comet Hangar.

Architects: James M. Monro & Son.

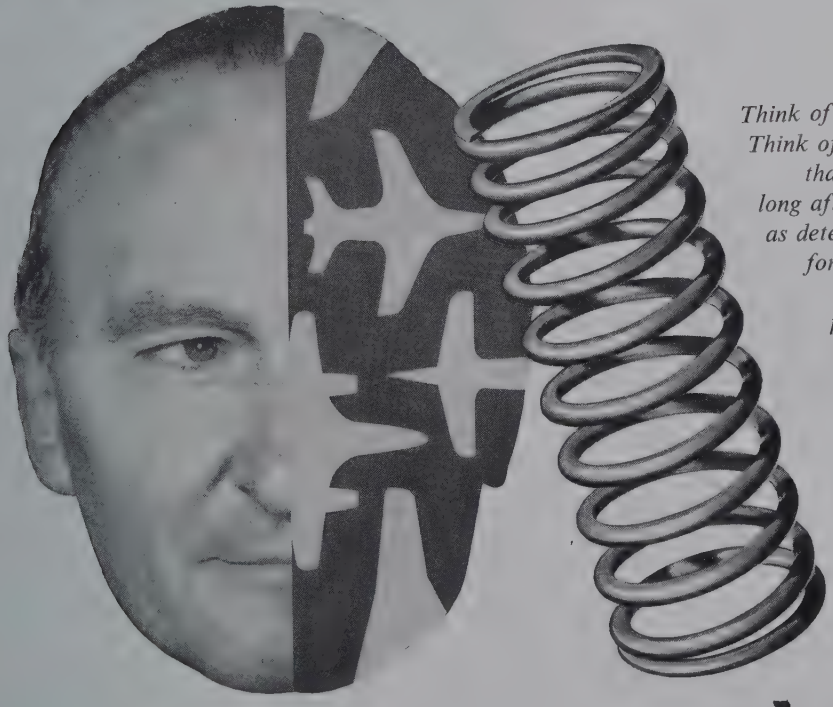
Our technical staff can offer a wealth of experience and information to architects and consulting engineers who have special problems.

Esavian Ltd., Esavian Works, Stevenage, Herts. Tel: Stevenage 500

THE ESAVIAN PRINCIPLE

FOR FOLDING & SLIDING DOORS, WINDOWS, PARTITIONS AND SCREENS

SALTER...



Think of springs and you think of Salter. Think of Salter and you think of springs that do their job and go on doing it long after you expect them to. We are as determined to uphold our reputation for dependability as you are to buy the finest springs the trade can produce—whether they are made to your specification or designed by our own specialists

...always a spring ahead!

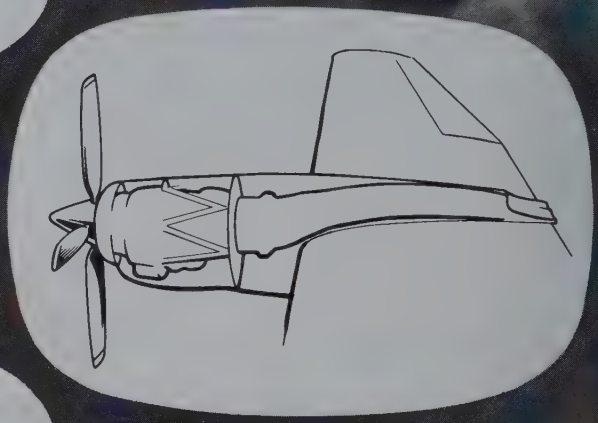
GEO. SALTER & CO. LTD., WEST BROMWICH, ENGLAND *Established 1760*

THESE ARE THE POINTS WHICH MAKE THE



Massive Freight Holds
Two holds provide space for up to ten tons of cargo. This gives ample room for spacing out consignments for stops along the route. The unusually generous headroom (4 ft. 8 in.) makes handling simple.

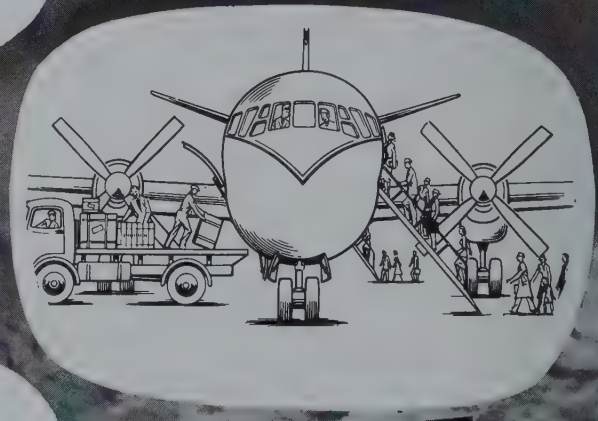
Low Noise Level
Large propellers with low tip-speed, combined with Rolls-Royce Tyne turbine engines, reduce interior and exterior noise to a minimum.

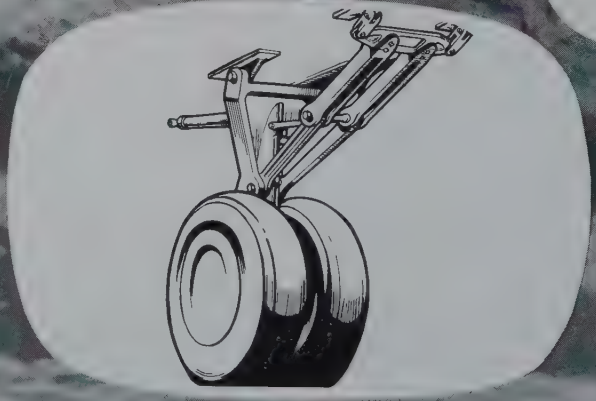




Interior Comfort . . .
Excellent Outlook
Large picture windows give every passenger a clear view. Call-bells, individual ventilation adjustment, and reading lamps are within comfortable reach.

Unobstructed access
The wide freight doors are at a convenient truck-loading height. Freight is loaded on the opposite side of the aircraft to passengers, speeding turn-round operations.





Low-pressure Undercarriage
The simple twin-wheel tricycle undercarriage has low-pressure tyres enabling the Vanguard to use most existing airfields without meeting bearing strength problems. In emergency the undercarriage can be gravity operated.

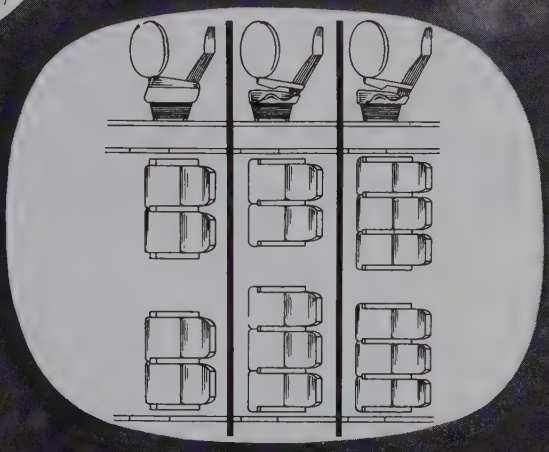
VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED

VANGUARD

THE AIRLINES' AIRLINER



Spacious Flight Deck
Comfort, soundproofing, and space are important features of the flight deck. The range of vision is exceptionally wide. All four engines and almost all the leading edge are visible from the cockpit. The pilot's controls are duplicated and manually operated throughout.



Flexibility of seating layouts
Three typical layouts for 76, 93, or 115 passengers. Seats are arranged as in the sketch, at a 39-in. pitch with a window to each row.



VICKERS VANGUARD

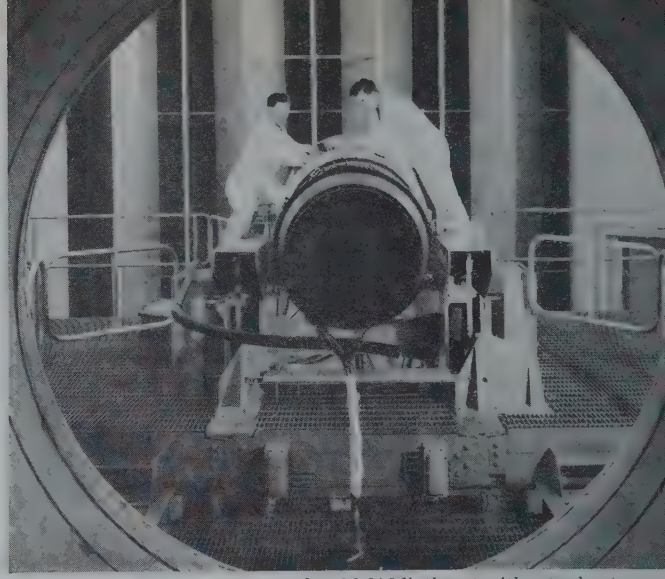
Four Rolls-Royce Tyne Propeller-Turbine Engines

WEYBRIDGE SURREY

TGA AT 528



Sycamore—in service throughout the world and in quantity production



Olympus engine—type-tested at 16,000 lb thrust without reheat

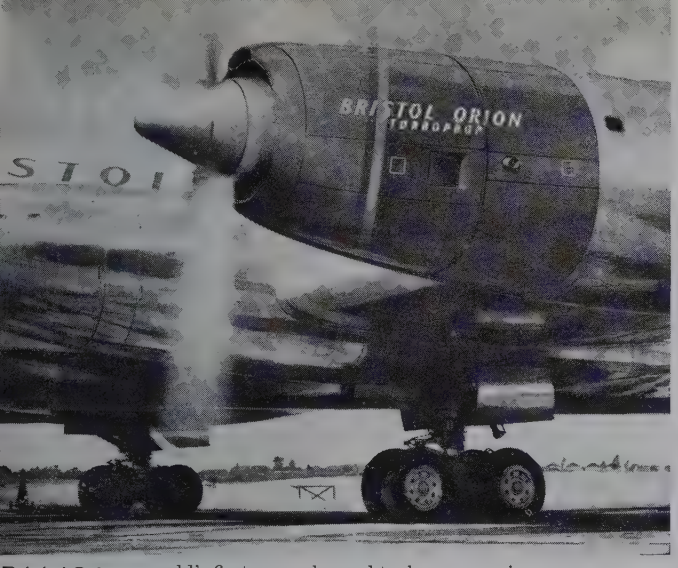
BRISTOL IN



Britannia 100 series—in service with British Overseas Airways Corporation

Britannia 300 series—as ordered by Northeast Airlines of America





Bristol Orion—world's first supercharged turboprop engine



Bloodhound Defence System—in production for UK air defence

WORLD AVIATION

Not only with the versatile Britannia, but also in their work on helicopters, turbojets and turboprops, ramjets and guided missiles, the Bristol Group of Companies is helping to forward the scope of aviation.

The Britannia—in world-wide service. The Britannia is now in service on regular passenger routes across the world. A large part of the Group's resources is devoted to the production of Britannias and their Proteus engines.

More orders for Helicopters. Bristol Sycamore five-seat helicopters are in widespread service around the world, and progress with research and development on larger helicopters has resulted in an order for the twin-engine tandem-rotor Type 192 for the Royal Air Force.

The Bristol family of Aero-Engines. The Orpheus lightweight turbojet is the only engine specifically developed for lightweight fighters. The Olympus is the world's most powerful type-tested turbojet. The Orion supercharged turboprop is the most advanced engine of its kind in the world.

Guided Weapons and Ramjets. Bristol/Ferranti Bloodhound surface-to-air missiles have been chosen as the mainstay of UK air defence. They are powered by Bristol Thor-type ramjets. Hundreds of test missiles have been powered by the Thor and many have flown higher, faster and farther than any other British ramjet vehicle. Rocket motor tubes and pressure vessels are also made for a wide range of missiles.

Other Bristol activities. The Group also manufactures plastic drop-tanks and high performance motor cars. The following companies are associated with Bristol: Rotol, British Messier, Short Brothers and Harland. There are associated and subsidiary companies in Australia, Canada, Mexico, New Zealand, France, Spain, and the United States.

BRISTOL

THE BRISTOL AEROPLANE COMPANY LIMITED

Britannia 310 series—long-range version ordered for world-wide service



ROLLS-ROYCE

GAS TURBINES

for

short, medium

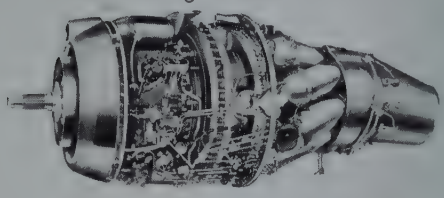
and long range

airliners

DART

PROP-JET

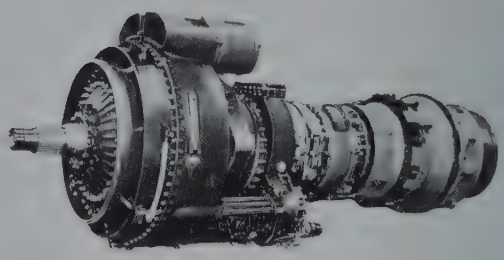
Vickers Viscount · Fokker Friendship
Aviation Traders Accountant
Armstrong Whitworth 650



TYNE

PROP-JET

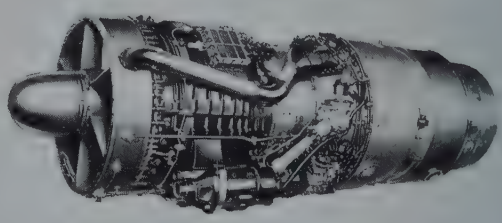
Vickers Vanguard



AVON

TURBO JET

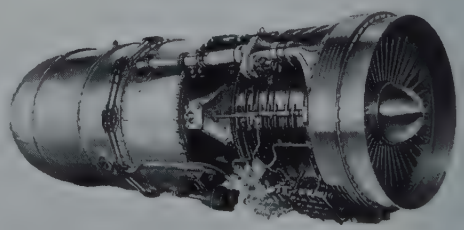
de Havilland Comet
Sud-Aviation Caravelle



CONWAY

BY-PASS TURBO JET

Boeing 707 · Douglas DC-8



ROLLS-ROYCE LIMITED · ENGLAND · SCOTLAND · CANADA · AUSTRALIA

JANE'S ALL THE WORLD'S AIRCRAFT

1957-58

FOUNDED BY FRED T. JANE IN 1909

COMPILED AND EDITED BY
LEONARD BRIDGMAN

ASSISTANT COMPILER :
JOHN W. R. TAYLOR

NEW YORK:
THE McGRAW-HILL BOOK COMPANY, INC.

Contra Costa County
Library

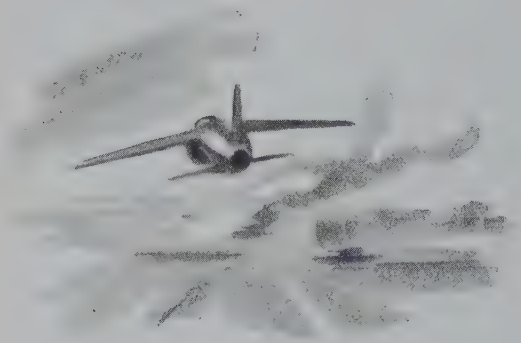
Copyright © 1957 Jane's All The World's Aircraft Publishing Co. Ltd.

Printed in Great Britain

The Versatile GNAT

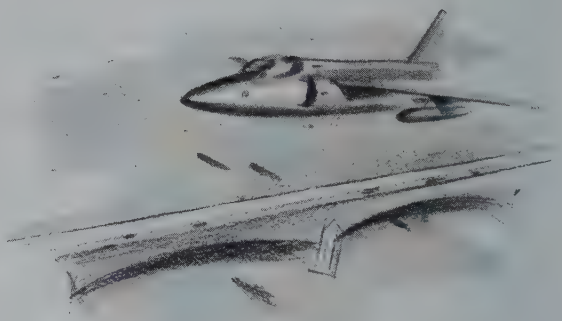
The Gnat, originally designed and built by Folland Aircraft as a "private venture" light interceptor fighter to meet the needs of countries which could neither build nor buy conventional fighters, is now available in three additional roles—fighter-bomber, tactical reconnaissance aircraft, and two-seat transonic trainer.

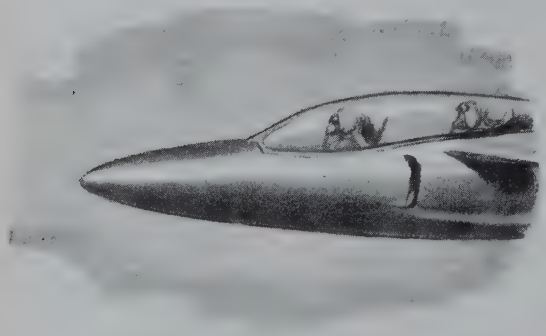




As a fighter-bomber operating from temporary airstrips the Gnat can carry heavy loads of bombs and rockets on under-wing pylons. External tanks can be fitted to increase duration on low-level sorties.

As a tactical reconnaissance aircraft, the Gnat can be fitted with three or more high-speed cameras whilst retaining, if required, the Aden gun armament. Radius of action at low level could be up to 200 n.m.





As a two-seater intermediate and advanced transonic trainer the Gnat bridges the ever-widening gap between *ab initio* and operational flying. It is fully aerobatic and carries fuel for a 75-minute training flight plan in internal tanks. Under-wing tanks give an additional 60-minutes flying time, if required.

All three versions have the same basic characteristics as the Interceptor Gnat—high performance, ease of handling, low maintenance time, low initial and operating costs—and all can be built wherever modern production facilities exist.

FOLLAND AIRCRAFT LIMITED · HAMBLE · SOUTHAMPTON · HAMPSHIRE

98 adv.

CONTENTS

PAGE

PREFACE – – – – – – – – – – – – – – – – i

INDEX OF AIRCRAFT AND MANUFACTURERS – – – – – – – – – – – iii

INDEX OF ROTARY WING AIRCRAFT AND MANUFACTURERS – – – – – – – – xvii

INDEX OF ENGINES AND MANUFACTURERS – – – – – – – – – – – xix

MILITARY AVIATION

MARKINGS OF THE AIR FORCES OF THE WORLD – – – – – 1

CIVIL AVIATION

INTERNATIONAL CIVIL AIRCRAFT MARKINGS – 8

INTERNATIONAL CIVIL AVIATION ORGANIZATION (I.C.A.O.) – – – – – – – 9

INTERNATIONAL AIR TRANSPORT ASSOCIATION (I.A.T.A.) – – – – – – – 9

FEDERATION AERONAUTIQUE INTERNATIONALE (F.A.I.) – – – – – – – 11

OFFICIAL WORLD'S RECORDS RECOGNISED BY F.A.I. – – – – – – – – 12

CIVIL AIRLINE OPERATORS

ADEN – – – – – – – – 13

AFGHANISTAN – – – – – – – 13

ALASKA – – – – – – – – 13

ALGERIA – – – – – – – – 13

ARGENTINA – – – – – – – 13

AUSTRALIA – – – – – – – – 14

AUSTRIA – – – – – – – – 15

BAHRAIN – – – – – – – – 15

BELGIUM – – – – – – – – 15

BOLIVIA – – – – – – – – 15

BRAZIL – – – – – – – – 15

BRITISH CENTRAL AFRICA – – – – 17

BRITISH EAST AFRICA – – – – 17

BRITISH GUIANA – – – – – 17

BRITISH HONDURAS – – – – – 17

BRITISH WEST AFRICA – – – – 17

BRITISH WEST INDIES – – – – – 17

BULGARIA – – – – – – – – 18

BURMA – – – – – – – – 18

CAMBODIA – – – – – – – 18

CANADA – – – – – – – – 18

CEYLON – – – – – – – – 19

CHILE – – – – – – – – 19

CHINA – – – – – – – – 19

COLOMBIA – – – – – – – 20

COSTA RICA – – – – – – – 20

CUBA – – – – – – – – 20

CYPRUS – – – – – – – – 20

CZECHOSLOVAKIA – – – – – – 20

DENMARK – – – – – – – – 20

DOMINICAN REPUBLIC – – – – – 21

ECUADOR – – – – – – – – 21

EGYPT – – – – – – – – 21

EL SALVADOR – – – – – – – 21

ETHIOPIA – – – – – – – – 21

FIJI ISLANDS – – – – – – – 21

FINLAND – – – – – – – – 21

FRANCE – – – – – – – – 21

FRENCH EQUATORIAL AFRICA – – – 22

FRENCH GUIANA – – – – – – 22

GERMANY – – – – – – – 22

GIBRALTAR – – – – – – – 22

GREAT BRITAIN – – – – – – – 22

GREECE – – – – – – – – 25

GUATEMALA – – – – – – – 25

HAITI – – – – – – – – 25

HAWAIIAN ISLANDS – – – – – – 25

HONDURAS – – – – – – – – 26

HONG KONG – – – – – – – 26

HUNGARY – – – – – – – – 26

ICELAND – – – – – – – – 26

INDIA – – – – – – – – 26

INDO CHINA – – – – – – – 26

INDONESIA – – – – – – – – 26

IRAN – – – – – – – – 26

IRAQ – – – – – – – – – 27

IRELAND – – – – – – – – 27

ISRAEL – – – – – – – – 27

ITALY – – – – – – – – 27

JAPAN – – – – – – – – 27

JORDAN – – – – – – – – 27

KOREA – – – – – – – – 27

KUWAIT – – – – – – – – 27

LEBANON – – – – – – – – 28

LIBERIA – – – – – – – – 28

MADAGASCAR – – – – – – – 28

MALAYA – – – – – – – – 28

MALTA – – – – – – – – 28

MEXICO – – – – – – – – 28

MOROCCO – – – – – – – – 29

NETHERLANDS – – – – – – – 29

NETHERLANDS ANTILLES – – – – 29

NETHERLANDS NEW GUINEA – – – 29

NEW CALEDONIA – – – – – 30

NEW GUINEA – – – – – – – 30

NEW ZEALAND – – – – – – – 30

NICARAGUA – – – – – – – 30

NORWAY – – – – – – – – 30

PAKISTAN – – – – – – – – 30

PANAMA – – – – – – – – 30

CIVIL AIRLINE OPERATORS—*continued*

PAGE

Peru – 31
Philippines – 31
Poland – 31
Portugal – 31
Portuguese Azores – 31
Portuguese East Africa – 31
Portuguese India – 31
Portuguese Timor – 31
Portuguese West Africa – 31
Puerto Rico – 31
Rumania – 31
Saudi Arabia – 31
Scandinavia – 32
South Africa – 32
South West Africa – 32
Soviet Union – 32
Spain – 32
Sudan – 32
Sweden – 32
Switzerland – 33
Syria – 33
Tahiti – 33
Taiwan (Formosa) – 33
Thailand – 33
Tunisia – 33
Turkey – 33
Uruguay – 33
United States of America – 33
Venezuela – 38
Vietnam – 39
Yugoslavia – 39

AEROPLANES

Some First Flights made during period July 30, 1956—August 9, 1957 – 42
Argentina – 43
Austria – 44
Belgium – 45
Brazil – 46
British Commonwealth
Great Britain – 49
Australia – 114
Canada – 118
India – 127
Bulgaria – 128
Chile – 128
Czechoslovakia – 129
Denmark – 134
Egypt – 134
Finland – 135
France – 138
Germany – 172
Hungary – 180
Indonesia – 181
Italy – 182
Japan – 194
Netherlands – 197
Philippine Republic – 202
Poland – 203
Portugal – 208
Rumania – 208
Soviet Union – 210
Spain – 225
Sweden – 233
Switzerland – 238
Turkey – 239
United States of America – 240
Yugoslavia – 373

GUIDED MISSILES

– 377

GAS-TURBINE ENGINES

Belgium – 390
British Commonwealth
Great Britain – 391
Canada – 415
France – 418
Germany – 427
Italy – 428
Japan – 429
Poland – 429
Soviet Union – 430
Sweden – 431
United States of America – 432

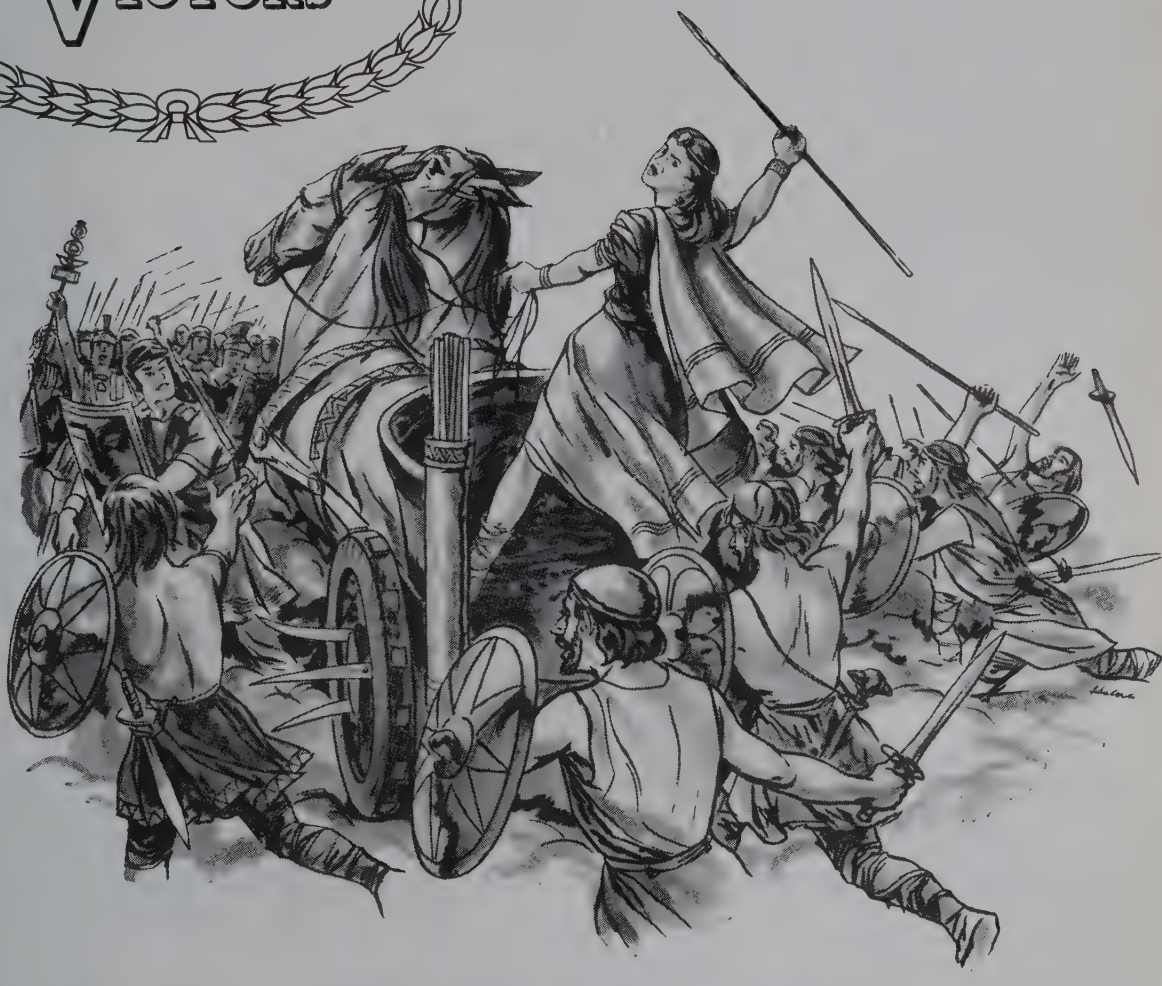
PISTON ENGINES

Great Britain – 451
Czechoslovakia – 461
France – 463
Germany – 466
Italy – 467
Poland – 468
Soviet Union – 469
Spain – 470
United States of America – 472

AIRSHIPS

United States of America – 486

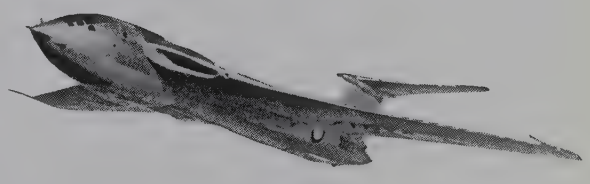
VICTORS



RANGED AGAINST THE INVADER

BOADICEA refused to submit to the armed might of Roman colonisers. Under her leadership, the British clans fought back. They attacked the foreign settlements and left London and Verulamium in flames.

Today the British peoples rely for active defence on the effective far-reaching striking power of the . . .



VICTOR — BRITAIN'S PREMIER STRATEGIC BOMBER

HANDLEY PAGE RADLETT LONDON READING



29 years

of experience in making precision—

Flight and Engine Aircraft Instruments • Air Data Computers and Electromechanical Systems • Optical Systems and Components • Test Instruments for Aeronautical and Industrial Laboratories • Motors and Synchros • Instruments for Simulated Flight Trainers • Pressure Sensitive Controls for Aircraft and Guided Missiles;
Monitors — Switches — Transmitters — Pickups — Cabin Pressure Regulators

Navigation Devices: *Sextants: Periscopic — Handheld — Photoelectric • Astro Trackers*
Automatic Astrocompass • Doppler Computation Systems

Send for Illustrated Product List covering all Kollsman Products.

kollsman INSTRUMENT CORPORATION

80-08 45th AVE., ELMHURST, N. Y. • GLENDALE, CALIF. • SUBSIDIARY OF *Standard* COIL PRODUCTS CO. INC.

PREFACE

THE year 1957 produced the first tangible signs, as opposed to forecasts, of the great technical and social changes which are facing the aeronautical world of the not too distant future. The United Kingdom's White Paper on Defence set the scene by announcing the biggest and most revolutionary change in defence policy ever made in normal times. Noting "likely progress in ballistic rockets and missile defence" the White Paper wrote the British obituaries for the manned fighter more advanced than the P.1 and for the supersonic bomber, even before the one was properly dead and the other had been born. A small but adequate force of fighters will be maintained and it will be progressively armed with air-to-air missiles. However, "such fighters will in due course be replaced by a ground-to-air guided missile system". Britain's present force of V-bombers will eventually be supplemented by ballistic weapons and "agreement in principle has recently been reached with the U.S. Government for a supply of medium-range missiles of this type".

The United States, which is also embarrassed by the astronomical costs of the technological development and production of modern weapons, has not yet gone so far as to condemn out of hand the combat aeroplane as we know it to-day, but is making concessions to its Treasury by slow-downs, cutbacks and, in some cases, by cancellations of contracts, while pursuing a revised programme calculated to get the best value for the money available. The American industry is already working on design studies for a so-called chemically-powered Mach 2 manned bomber as a successor to the B-52 and the supersonic B-58.

Only a modest number of relatively short-range U.S. missiles have yet reached operational status, while the picture of America's vast medium and long-range ballistic missile programme has, regrettably, been confused by the widely-publicised reports of some unsuccessful launchings, plus the many statements of rival spokesmen in and out of uniform. This is not intended to deprecate in any way the tremendous work being undertaken by the United States which, insofar as the ballistic missile programme of the three U.S. services is concerned will, by the time one or more perfected weapons are fully operational, probably cost twice as much as the project which developed the first nuclear weapon.

As long ago as last April (1957) there appeared a report that the Soviet Union had organised a new "rocket force" on a basis of equality with the army, navy and air force, to take over missile development and air defence. Accorded little prominence in the World's press, it was dismissed as a panic move by a Russia "frightened" by the West's shift to nuclear, rocket and missile defence.

It is interesting to recall this report, true or not as it may be, in the light of more recent happenings. Russia's announcement of the successful firings of its first I.C.B.M. has now been followed by the astounding and epoch-making launching of two artificial satellites which at the time of writing were circling the globe in orbits of some 500 and 900 miles respectively. One or even two Sputniks do not necessarily possess real military significance, but they do prove that Russia is far in advance of the West in the means of projecting objects, and very weighty objects, into space.

Dr. Simon Ramo, of the Ramo-Woodridge Corporation, which has overall technical direction of the U.S.A.F.'s ballistic missile programme, said last April that he looked upon the development of the Inter-Continental Ballistic Missile as an "enormous step" toward man's extending his province into space. That the first giant stride into space has been successfully taken by the Russians can but excite the most profound admiration for a brilliant and truly fantastic achievement. It can also add confusion to a World which has to concede to Russia the successful negotiation of the first obstacle towards the attainment of "space supremacy", with all that is implied, scientifically and otherwise, by this new term.

The compilation of this new edition of "All the World's Aircraft" has followed the usual processes of complete revision and re-setting of text and the introduction of, in this case, some 590 new illustrations, the greatest number for many years.

The section devoted to the markings of the Air Forces of the World has had several new insignias added, while the Airlines of the World tabulation contains probably the most complete record of the composition and the 1956 basic traffic figures of 297 scheduled airlines and other operators maintaining scheduled services as part of their activities throughout the World. For 1956 figures to appear in a 1957-58 publication it should be explained that traffic figures for a complete calendar year cannot be made available by the airlines until sometime in the first half of the following year.

In 1957 the major airlines of the World had on order a total of nearly 1,300 multi-engined aircraft of which some 460 were piston-engined, 490 turboprop-powered and 330 pure jet aircraft. Already over 200 turboprop airliners were in service and a further 150 were being delivered in 1957. The first trickle of deliveries of pure jet airliners is due in 1958, but over 100 are scheduled for delivery in 1959 and nearly 200 in 1960, by which time the much-heralded Jet Age will be with us.

The Aeroplane Section is comprised of 339 pages, twenty-five more than last year, and contains a total of 761 illustrations, of which 434 are new. Without giving a complete breakdown of this section by countries it can be noted that Great Britain, Canada, Czechoslovakia, East and West Germany, Poland and the United States all show increases in the number of pages compared with last year.

The products of 33 countries are dealt with in this section, with the United States occupying 140 pages, Great Britain 65 pages and France 33 pages, and with Austria and Bulgaria making a modest reappearance after an absence of twenty years, and Eastern Germany and Egypt a first appearance in this publication. The Russian section of 14 pages does not contain much new military information, largely because the 1957 military display at Tushino at which it has been customary for the Soviet Air Force to show off its latest aircraft was cancelled at the last moment. Instead Russia sprang a surprise by revealing the very real existence of three new gas-turbine-engined transports, one pure jet and two turboprop-powered. The Russian state airline Aeroflot has already announced that these three airliners will be introduced into scheduled service "during the coming months". Russia's first jet airliner, the Tu-104, is already operating on Aeroflot's long distance routes. A progressive development of it, the Tu-104A, carrying a payload of approximately 10 tons, set up in 1957 an international record for speed over a 1,000-kilometre closed circuit at 603.6 m.p.h. (972.8 km.h.), the previous holder having been a single-seat jet fighter. And, just as this is being written photographs of the Tu-114, which is briefly mentioned on page 220, were released to show it to be of characteristic Tupolev design and to be powered by four large turboprops said to develop some 12,000 e.h.p. each. The Tu-114 is claimed to have normal accommodation for 180 passengers (220 in a high-density version), a cruising speed of 495 m.p.h. (800 km.h.) and a maximum range (carrying 120 passengers) of 4,350 miles (7,000 km.).

One significant fact to note in the Aeroplane Section is the part most of the big firms in the major aircraft producing countries are now playing in the development of guided missiles. Although reference is made to the missile work being done by the individual manufacturers concerned, fuller tabular information is given under Guided Missile and Test Vehicle Section which follows the Aircraft Section on page 377 *et sec.* This dual treatment is not the ideal way to deal with this increasingly important segment of aircraft industry and now that more information is steadily becoming available, and because firms and establishments outside the aircraft industries are engaged in this work, it is planned to set up a completely self-contained Guided Missile Section in future.

The Aero-Engine Section contains a total of 94 pages, of which 61 are devoted to gas turbine power plants and rocket motors. The section as a whole has 160 illustrations of which 59 are new.

The U.S. Navy continues to be the only user of lighter-than-air craft and the Goodyear Aircraft Corporation the sole supplier of such craft to the U.S. Navy. The small Airship Section gives all available details of the U.S. Navy's airships.

In conclusion, I would like to pay tribute to my assistant compiler, John W. R. Taylor, whose encyclopaedic knowledge and inexhaustible industry has been invaluable. Thanks are also due to Mr. L. E. Bradford for his work as a draughtsman, and to my good friends Warren Bodie and Gordon Williams whose skill with the camera has produced many new and striking photographs to provide added interest to the American pages.

L.B.

INDEX SECTION

Aircraft - - - - -	page	iv
Rotary Wing Aircraft - - -	,,	xvii
Gas Turbine Engines - - -	,,	xix
Piston Engines - - - -	,,	xxi

In addition to references to all items in this edition, each index contains references to every aircraft and engine described in the ten previous editions of Jane's "ALL THE WORLD'S AIRCRAFT" going back to and including 1947.

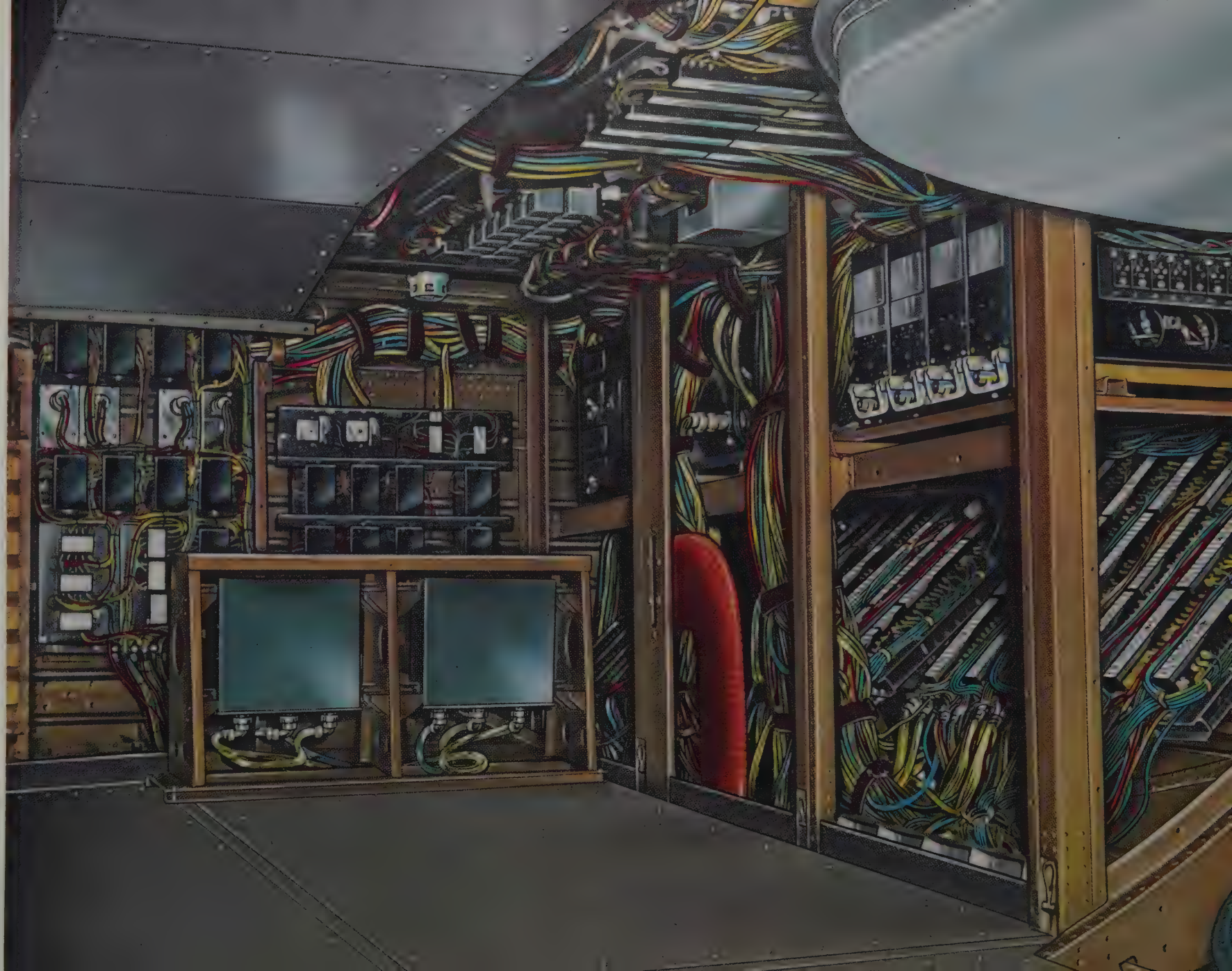
The illustration shows part of the Plessey preformed wiring fitted in the cargo hold of the Bristol Britannia.

Plessey

Products for the Aircraft industry include:

ACTUATORS
AIR MOTOR RAMS
AIR STARTERS
AIR VALVES
CONNECTORS
CONVERTERS
COMMUNICATIONS EQUIPMENT
CRIMPED CONNECTIONS
ELECTRONIC COMPONENTS
FLASHERS
FUEL CONTROL SYSTEMS
G.W. POWER PACKS
IGNITION HARNESS
INVERTERS
MAGNETIC INDICATORS
MONOFUEL TURBINE STARTERS
PUMPS
RADAR ABSORBENT MATERIAL
RAM AIR TURBINES
RELAYS
ROTARY TRANSFORMERS
SEAMLESS FLEXIBLE METAL HOSE
SERVO COMPONENTS
SWITCHGEAR
TERMINAL BLOCKS
WIRING SYSTEMS

Aircraft & Automotive Group,
The Plessey Company Limited,
Ilford, Essex, England.



GENERAL INDEX OF AIRCRAFT

Items printed in this type refer to this edition.
Items printed in italics refer to previous editions.

PAGE

A

A.1 Canberra (English Electric) .. 68
A-2 (Antonov) .. .. (1950-51) 167c
A-2 (Emigh Trojan) .. (1951-52) 235c
A-2 and A-3 (Call-Air) .. (1952-53) 185
A-2 (Saab) .. .. (1955-56) 205
A2D-1 (Douglas) .. (1954-55) 240
A2U (Chance-Vought) .. (1954-55) 224
A.2/45 (Auster) .. .. (1950-51) 19c
A3D Skywarrior (Douglas) .. 286
A3J (North American) 338
A4D Skyhawk (Douglas) 285
A-4 "150" (Callair) .. (1956-57) 245
A-4 AG (Callair) 262
A.4/45 (Scottish Aviation) .. (1949-50) 74c
A-7 (Antonov) .. .. (1949-50) 162c
A 21 (Saab) .. .. (1951-52) 187c
A.26B (Douglas) .. (1947) 224c
A29 (Saab) 236
A32A (Saab) 234
A35 Bonanza (Beechcraft) .. (1949-50) 191c
A 32A (Saab) .. .. (1955-56) 204
A.B.C. (Dassault) .. (1951-52) 123c
AC-12 (Aerotecnica) 225
ABC-A (Poland) 206
AC-13 (Aerotecnica) .. (1955-56) 197
AC-13A (Aerotecnica) 225
AC-14 (Aerotecnica) 226
AD Skyraider (Douglas) 288
AD-1 (Douglas) .. .. (1948) 253c
A.E.R.1 (Aernova) .. 1949-50) 139c
AF Guardian (Grumman) .. (1955-56) 265
AFA-1 Streak 85 (Aero Flight) (1950-51) 196c
AFA-2 Streak 152 (Aero Flight) (1950-51) 196c
AFA-3 Streak 165 (Aero Flight) (1952-53) 171
Ag-1 (Texas A. & M. College) (1953-54) 277
Ag-2 (Transland) 369
Ag-3 (Texas A. & M. College) .. 368
AG-14 (Anderson, Greenwood) (1951-52) 196c
AISA (see Aeronautica Industrial S.A. 226
AJ Savage (North American) (1955-56) 298
AL 12P (S.A.I. Ambrosini) (1948) 173c
A.L.06 (S.N.C.A.C.) .. (1947) 116c
A.L.T. (Lombardi) .. (1947) 148c
AM (Martin) .. .. (1948) 293c
AM-1 Mauler (Martin) .. (1951-52) 266c
AM.8 (Alaparma) .. (1950-51) 146c
AM.10 Tucano (Alaparma) .. (1950-51) 146c
AM.65 Balda (Alaparma) .. (1950-51) 146c
AN-2 (Antonov) 210
AN-8 (Antonov) 211
AN-10 (Antonov) 211
AN-14 (Antonov) 212
A.O.P.9 (Auster) 51
AP.65 Baldo (Alaparma) .. (1952-53) 137
AP-75 Baldo (Alaparma) .. (1952-53) 137
ARS.5.501 (Nord) .. (1956-57) 151
A.S.10 Oxford (Airspeed) .. (1947) 10c
A.S. 57 (Starck) .. .. (1953-54) 129
A.S. 57 (Airspeed) .. (1955-56) 46
A.S. 59 (Airspeed) .. (1951-52) 16c
A.S. 65 Consul (Airspeed) .. (1950-51) 16c
A.S. 67 (Airspeed) .. (1950-51) 16c
A.S. 70 JAC (Starck) (1948) 155c
A.S, 80 Holiday (Starck) .. (1953-54) 149
AT-6 Texan (North American) (1948) 304c
AT-21 (Aviolanda) 197
ATL 90 (Aviation Traders) .. 54
ATL 91 (Aviation Traders) .. 54
AU-1 (Chance-Vought) .. (1952-53) 189
A. V. Roe & Co., Ltd. (G.B.) (1955-56) 52
A. V. Roe Canada, Ltd. .. (1955-56) 113
A.V.1.A. (see Lombardi) .. (1948) 168c
AVD-12 (AISA) 226
A.W.52 (Armstrong Whitworth) (1950-51) 18c
A.W.55 Appollo (Armstrong Whitworth) .. .. (1951-52) 17c
AW.650 (Armstrong Whitworth) .. 49
AW.651 (Armstrong Whitworth) .. 49
AW.660 (Armstrong Whitworth) .. 49
AW.661 (Armstrong Whitworth) .. 49
AW.670 (Armstrong Whitworth) .. 49
AW.671 (Armstrong Whitworth) .. 49
AZ-8L (Agusta) 183
Abeille N.C.2001 (S.N.C.A.C.) (1949-50) 113c
Accountant (Aviation Traders) .. 54
Achilles (Armstrong Whitworth) (1947) 12c
ADAM, ETABLISSEMENTS AERONAUTIQUES R. (France) (1956-57) 127
AERAUTO S.A. COSTRUZIONI AERONAUTICHE E MECCANICHE (Italy) .. .. (1953-54) 136

PAGE

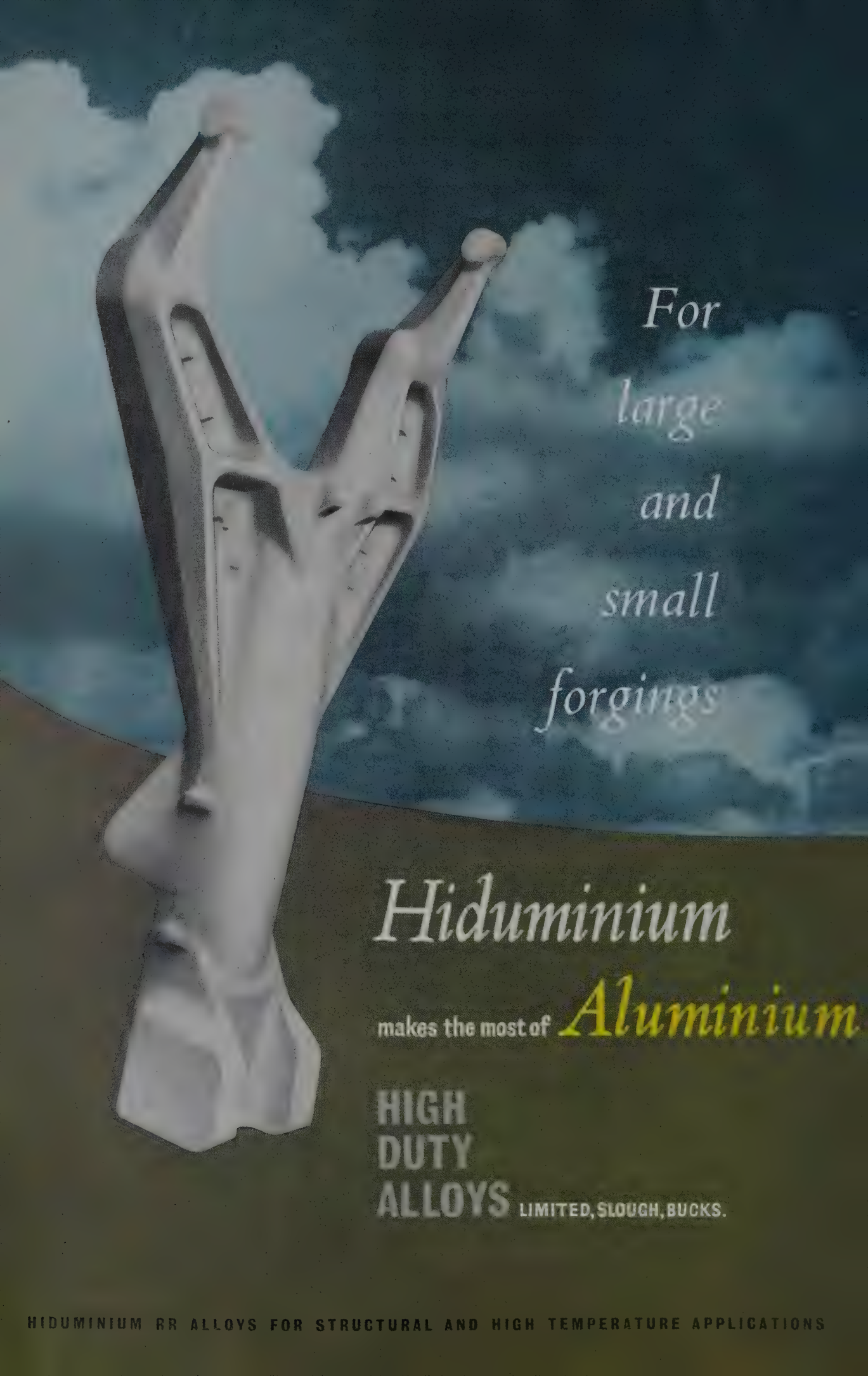
AERFER-INDUSTRIE MECCANICHE AERONAUTICHE MERIDIONALI (Italy) 150
Aero-2 (Yugoslavia) 374
Aero-3 (Yugoslavia) 374
Aero 45 (Czechoslovakia) .. (1955-56) 126
Aero 54 (Czechoslovakia) .. (1950-51) 112c
Aero HC-2 (Czechoslovakia) .. (1956-57) 121
Aero 101 (Indraero) (1956-57) 142
Aero 110 (Indraero) .. (1956-57) 141
Aerocar (Portsmouth) .. (1948) 86c
AEROCENTRE (see Centre) (1948) 133c
Aerocycle (De Lackner) 281
AERO CAPRONI TRENTO (Italy) (1954-55) 163
Aero Commander 560E (Aero) .. 241
Aero Commander 680 Super (Aero) .. 241
AERO-DIFUSIÓN S.L. (Spain) .. 225
AERO DESIGN & ENGINEERING CO. (U.S.A.) 241
AERO EVER (Hungary) .. (1951-52) 149c
AERO-FLIGHT AIRCRAFT CORPORATION (U.S.A.) (1952-53) 171
AERO FLUGZEUGBAU HUBERT ZUERL (Germany) 172
AERO KONSTRUKTORSKI BIRO (Yugoslavia) .. .. (1955-56) 301
Aerocar (Portsmouth) .. (1947) 70c
AEROCAR, INC. (U.S.A.) .. 242
Aerocycle (De Lackner) 281
Aerojeep (Miles) 94
Aero-Jodel D.9a Bébé 172
Aero-Jodel D.112 Club 172
AERONAUTICA INDUSTRIAL S.A. (Spain) 226
AERONCA MANUFACTURING CORPORATION (U.S.A.) .. 243
Aeronça Super Chief 11CC (1948) 213c
Aeronca Arrow .. (1947) 176c
Aeronca Chum .. .. (1947) 177c
Aeronca Champion .. (1947) 177c
Aeronca Chief .. .. (1947) 178c
Aeronca 15AC Sedan .. (1948) 212c
Aeroscooter P-53 (Partenavia) .. 189
AEROTECNICA S.A. (Spain) .. 225
Aerovan (Miles) .. .. (1955-56) 91
Ag-2 (Transland) .. .. (1955-56) 319
Ag-3 (Texas) .. .. (1955-56) 318
Agricola (Auster) 51
AGUSTA, COSTRUZIONI AERONAUTICHE GIOVANNI (Italy) .. 182
Agusta-Bell Model 47 183
Aiglet Trainer (Auster) 52
Air-100 (Arsenal) .. (1950-51) 117c
Air Baby (Praga) .. (1948) 126c
AIR-FOUGA (France) 150
Air Horse (Saunders Roe) (1951-52) 75c
Air Tractor (Lamson) 313
AIRCRAFT MANUFACTURING COMPANY (U.S.A.) .. (1951-52) 292c
Aircoupe (Forney) 297
Airone (Pasotti) 190
Airphibian FA-2 (Fulton) .. (1953-54) 209
AIRSPEED DIVISION OF THE DE HAVILLAND AIRCRAFT CO., LTD. .. .. (1955-56) 46
ALAPARMA S.p.a. (Italy) (1952-53) 137
Albatross (Grumman) 304
Alcotan 201 (CASA) 228
Alcyon (M-S) .. .. (1955-56) 149
Alize (Breguet) 140
All American Ensign .. (1947) 178c
Allievo Cantu (Ambrosini) .. (1950-51) 148c
ALI VIBERTI S.p.a. (Italy) (1951-52) 162c
Alouette (Sud-Est) .. .. (1953-54) 151
Alouette II (Sud) 170
Alpha (Auster) 52
Alpine (Auster) 53
Ambassador (Airspeed) .. (1955-56) 46
AMBROSINI (See Societa Aeronautica Italiana, Ing. A. Ambrosini & C.) 183
American Eaglet (American Eaglecraft) (1948) 215c
AMERICAN HELICOPTER COMPANY, INC. (U.S.A.) .. (1954-55) 206
AMERICAN HELICOPTER DIV., FAIRCHILD ENGINE and AIRPLANE CORP. (U.S.A.) (1955-56) 214
Amphibian (Yugoslavia) 375
ANDERSON, GREENWOOD & COMPANY (U.S.A.) .. (1953-54) 197
ANGKATAN UDARA (Indonesia) .. 181
Anjou (Boisavia) 138
Anson (Avro) .. .. (1952-53) 40
ANTONOV, OLEG K. (Russia) .. 210

PAGE

Apache (Piper) 348
Apollo (Armstrong Whitworth) (1951-52) 17c
Aqua 1 (Aquaflight) .. (1949-50) 189c
Aquilon (Sud) 167
Argus (Canadair) 121
Ariel II (Sud-Ouest) .. (1951-52) 148c
Ariel III (Sud-Ouest) .. (1954-55) 157
Aries M.75 (Miles) .. (1955-56) 91
Ariete (Aerfer) 182
Aristocraft (Waco) .. (1948) 324c
Armagnac (Sud-Est) .. (1953-54) 151
ARMSTRONG WHITWORTH AIRCRAFT LTD. Sir W. G. (G.B.) .. 49
Army Mule (Vertol) 370
Arrow (Auster) .. .. (1951-52) 21c
Arrow (Avro Canada) 118
Ars 1301 (S.F.E.C.M.A.S.) (1953-54) 147
Ars 5.501 (S.F.E.C.M.A.S.) (see Nord CT.10) .. .. (1955-56) 154
Arsenal 2301 .. .. (1952-53) 109
Arsenal 4111 .. .. (1950-51) 117c
Arsenal 5.501 .. .. (1953-54) 110
ARSENAL DE L'AERONAUTIQUE (France) (see Nord) .. (1955-56) 154
Ashton (Avro) .. .. (1952-53) 39
Asiago 2 (Ambrosini) .. (1950-51) 148c
Atar (Sud-Ouest) .. (1954-55) 155
Atar Volant /SNECMA) 164
Athena (Avro) .. .. (1951-52) 22c
Atlantic (Avro) .. .. (1953-54) 49
Atlantic (Auster) 52
Attacker (Supermarine) .. (1954-55) 99
AUBERT, PAUL (France) .. 138
Aula Volante (Fiat) .. (1951-52) 152c
AUSTER AIRCRAFT, LTD. (G.B.) .. 51
Auster Avis .. .. (1948) 24c
Auster A.O.P. Mk. 6 .. (1956-57) 46
Auster T. Mk. 7 .. (1956-57) 46
Auster A.O.P. Mk. 9 .. (1956-57) 46
Auster B.4 .. .. (1955-56) 50
Auster J.5 .. .. (1955-56) 50
Autocar (Auster) 53
Autocrat J/1 (Auster) .. (1955-56) 50
A. V. ROE & CO., LTD. (G.B.) .. 55
A. V. ROE CANADA, LTD. (Canada) (1955-56) 113
Avenger (Grumman) .. (1951-52) 246c
Avia 14 (Czechoslovakia) 132
Avia 36 (Czechoslovakia) .. (1947) 105c
Avia L-60 (Czechoslovakia) .. (1956-57) 121
Avia LD-40 (Czechoslovakia) (1956-57) 121
AVIAMILANO COSTRUZIONI AERONAUTICHE (Italy) .. 184
Aviaster (Lombardi) .. (1949-50) 147c
AVIATION TRADERS (ENGINEERING) LTD. (G.B.) .. 54
AVIOES MIGNET DO BRASIL (1953-54) 43
AVIOLANDA MAATSCHAPPIJ VOOR VLIEGTUIGBOUW N.V. (Netherlands) 197
AVIONS FAIREY S.A. (Belgium) .. 45
Avis 2 (Auster) .. .. (1951-52) 22c
Avitruc (Chase) .. .. (1953-54) 213
AVRO (see A. V. Roe & Co., Ltd.) .. 55
AVRO AIRCRAFT LTD. (Canada) .. 118
Avro Atlantic .. .. (1953-54) 49
Avro Flying Test Beds .. (1951-52) 26c
Avro 652A Anson .. (1952-53) 40
Avro 694 Lincoln .. (1951-52) 25c
Avro 696 Shackleton .. (1956-57) 50
Avro 698 Vulcan .. (1956-57) 50
Avro 701 (Athena) .. (1951-52) 22c
Avro 706 Ashton .. (1952-53) 39
Avro 707 .. .. (1955-56) 52
Avro C.102 .. .. (1950-51) 100c
Avro C.F.100 .. .. (1955-56) 113
Avro Tudor .. .. (1950-51) 25c
Azor (CASA) 230

B

B-2 (Brantly) 262
B-2 Monitor (Neiva) 47
B.4 (Auster) .. .. (1955-56) 50
B-7 Gyro-Glider (Benson) 252
B-7B Gyro-Boat (Benson) .. 253
B-7M Gyro-Copter (Benson) .. 253
B-7W Hydro-Glider (Benson) .. 253
B.8 Agricola (Auster) 51
B-11 (Billman) 253
B-12 (Yugoslavia) 373
B-17E (Boeing) .. .. (1947) 192c
B-17H (Boeing) .. .. (1947) 193c
B.18 (Saab) .. .. (1951-52) 187c
B.20 (Boeing) .. .. (1949-50) 199c


For
large
and
small
forgings
Hiduminium
makes the most of Aluminium
HIGH
DUTY
ALLOYS LIMITED, SLOUGH, BUCKS.
HIDUMINIUM RR ALLOYS FOR STRUCTURAL AND HIGH TEMPERATURE APPLICATIONS

PAGE

B.29 (Boeing) .. .. *(1951-52)* 208c
B.35 (Northrop) .. .. *(1949-50)* 264c
B.35 Bonanza (Beechcraft) .. *(1950-51)* 199c
B.36 (Convair) 276
B.36A (Convair) .. .. *(1948)* 239c
B.37 Firebrand (Blackburn) (1947) 23c
B.45 Firebrand (Blackburn) (1949-50) 29c
B-45 Mentor (Beechcraft) .. *(1955-56)* 216
B-45 Mentor (Fuji) .. *(1956-57)* 182
B.45 Tornado (North American) (1951-52) 273c
B.46 Firebrand (Blackburn) (1951-52) 27c
B-47 Stratojet (Boeing) 258
B.48 (Blackburn) .. *(1950-51)* 30c
B.50 (Boeing) .. .. *(1953-54)* 209
B.52 Stratofortress (Boeing) .. 257
B.56 (Boeing) .. .. *(1950-51)* 204c
B-57 Canberra (Martin) 332
B-58 Hustler (Convair) 274
B-60 Mercurey (Boisavia) 138
B-61 Matador (Martin) (see TM-61) (1955-56) 292
B-66 Destroyer (Douglas) 287
B-85-C (Funk) Bee .. *(1952-53)* 210
B.250 Brigadier (Baumann) (1949-50) 190c
B-260 Anjou (Boisavia) 138
B.290 Brigadier (Baumann) (1955-56) 214
B.320 (Macchi) .. .. *(1950-51)* 156c
B-360 De Luxe Brigadier (Baumann) .. 243
B-480 Super Brigadier (Baumann) .. 244
B-603 (Boisavia) .. *(1954-55)* 130
B-604 (Boisavia) .. *(1954-55)* 130
B-605 (Boisavia) .. *(1954-55* 130
Bax-3 and 4 (Bunyard) .. *(1948)* 231c
BB-1 Nelson Dragonfly .. *(1947)* 266c
BC 12D-65 Traveler (Taylorcraft) (1951-52) 291c
BC 12D-85 Sportsman (Taylorcraft) (1951-52) 291c
BE-6 (Beriev) 212
BE-8 (Beriev) 212
BHT-1 Beauty Single-seat Light Monoplane .. .. *(1947)* 166c
BICH (Cheranovskii) .. *(1950-51)* 167c
Bl.500 (Blume) 172
BN-1 (Neiva) 47
B.P. 471 (Breda) .. *1951-52)* 154c
BS-12 Twin (Omega) 345
BZ-4 Zuk (Poland) 205
B.Z. 308 (Breda) .. *(1951-52)* 153c
B.Z. 309 (Breda) .. *(1951-52)* 154c
Baby-Albatross (Laister-Kauffmann) (1948) 275c
Baby Eon (Elliotts) .. *(1950-51)* 55c
BACON CORPORATION, ERLE L. (U.S.A.) 243
Badger (Beechcraft) .. *(1956-57)* 229
Badger (Tupolev) 221
Bak. II (Poland) .. *(1951-52)* 168c
Balang (Philippine) .. *(1955-56)* 185
Baldo (Alaparma) .. .. *(1952-53)* 137
Balliol (Boulton Paul) .. *(1955-56)* 57
Banshee (McDonnell) .. *(1955-56)* 285
Bantam X-4 (Northrop) .. *(1951-52)* 276c
Barge (Tupolev) .. .. *(1955-56)* 193
Baroudeur (Sud) 167
Barougan (Dassault) 147
Barracuda (Fairey) .. *(1947)* 44c
Bartlett Zephyr .. .. *(1947)* 179c
BAUMANN AIRCRAFT CORPORATION (U.S.A.) 243
Beagle (Ilyushin) 213
Bear (Tupolev) 221
Bearcat G-58 (Grumman) .. *(1949-50)* 299c
BÉARN, CONSTRUCTIONS AERONAUTIQUES DU (France) (1956-57) 136
Beast (Ilyushin) .. .. *(1955-56)* 191
Beaufighter (Bristol) .. *(1950-51)* 39c
Beauty Single-seat Light Monoplane (1947) 166c
Beaver (D.H. Canada) 125
Bebe (Aero-Jodel) 172
Bébé (Jodel) 153
BEE AVIATION ASSOCIATES INC. (U.S.A.) .. .. *(1955-56)* 215
BEECH AIRCRAFT CORPORATION (U.S.A.) 244
BEECHCRAFT (see Beech Aircraft Corporation) 244
Beechcraft 34 .. .. *(1947)* 180c
Beechcraft 35 Bonanza .. *(1947)* 180c
Belfair (Avions Fairey) .. *(1949-50)* 9c
Belfair (Tipsy) .. .. *(1947)* 85c
BELL AIRCRAFT CORPORATION (U.S.A.) 248
BELL HELICOPTER CORPORATION (U.S.A.) 249
BELLANCA AIRCRAFT CORPORATION (U.S.A.) .. *(1956-57)* 236
Bellanca Model 14-13 Cruisair (1947) 187c
Bellairus (Bell) 251
Bellatrix (Sud-Ouest) .. *(1948)* 162c
Belphégor (S.N.C.A.C.) .. *(1949-50)* 113c

PAGE

BENSEN AIRCRAFT CORP. (U.S.A.) 252
Bergfalke 11/55 (Scheibe) 177
BERIEV, G.M. (Russia) 212
Beverly (Blackburn) 58
Bich-22 (Cheranovski) .. *(1949-50)* 162c
Bichao (I.P.T.) .. .. *(1951-52)* 13c
Bichinho (I.P.T.) .. *(1951-52)* 12c
Bies (Poland) 204
BILLMAN AVIATION COMPANY (U.S.A.) 253
Bipassaro (Movo) .. *(1949-50)* 149c
Bird Dog (Cessna) 264
Bison (Ilyushin) 212
BLACKBURN & GENERAL AIRCRAFT, LTD. (G.B.) 58
Black Widow Night Fighter (Northrop) (1947) 277c
Blanik (Czechoslovakia) 133
Blowlamp (Russia) 224
BLUME, INGENIEUR-BURO (Germany) 172
Bocian (Poland) 207
BOEING AIRPLANE COMPANY (U.S.A.) 253
BOISAVIA, SOCIETE (France) .. 138
Bomarc (Boeing) 261
Bonanza (Beechcraft) 244
Bonzo M.3 (Czechoslovakia) (1951-52) 111c
Boomerang (Commonwealth) .. *(1947)* 93c
Bosun (Tupolev) 221
Botond (Hungary) .. *(1956-57)* 168
BOULTON PAUL AIRCRAFT LTD. (G.B.) 59
Brabazon (Bristol) .. *(1952-53)* 45
BRANTLY HELICOPTER CORPORATION (U.S.A.) 261
BRATUKHIN, PROFESSOR IVAN P. (Russia) .. .. *(1951-52)* 170c
BREDA SOCIETA ITALIANA ERNESTO (Italy) .. *(1951-52)* 153c
BREGUET, SOCIÉTÉ ANONYME DES AVIONS LOUIS (France) .. 139
Breguet 482 .. .. *(1948)* 139c
Breguet 761 .. .. *(1948)* 138c
Breguet 890J .. .. *(1948)* 139c
Breguet 892S .. .. *(1948)* 140c
Bretagne (Sud-Ouest) .. *(1955-56)* 160
Brigadier (Baumann) 243
Brigadyr (Czechoslovakia) 130
Brigand (Bristol) .. *(1951-52)* 36c
BRISTOL AEROPLANE CO., LTD. (G.B.) 59
BRISTOL AEROPLANE COMPANY OF CANADA (1956) LTD. (Canada) 120
BRISTOL AIRCRAFT LTD. (G.B.) .. 59
BRISTOL AIRCRAFT (WESTERN) LTD. (Canada) 120
Bristol 170 .. .. *(1955-56)* 60
Bristol 171 .. .. *(1955-56)* 62
Bristol 173 .. .. *(1955-56)* 61
Bristol 175 54
Britannia (Bristol) 60
BROCHET, AVIONS MAURICE (France) 143
Broussard (Holste) 156
Buchon (Hispano) 230
Buck Private (American Helicopter) (1951-52) 196c
Buckaroo (Temco) .. *(1953-54)* 277
Buckmaster (Bristol) .. *(1947)* 29c
Bull (Tupolev) .. .. *(1955-56)* 193
Bullet 205 (Texas) .. *(1951-52)* 292c
BURGFALKE FLUGZEUGBAU (Germany) 172
Burnelli (C.C.F.) .. .. *(1947)* 96c
Bushmaster (Hayden) 306
Butcher (Ilyushin) .. *(1955-56)* 189

C

C-1 Hoppi-copter (Capital) .. *(1955-56)* 229
C-1 Skimmer (Colonial) 271
C-3 Trojka (Yugoslavia) 375
C-4 (Canadair) .. .. *(1948)* 115c
C-5 (Hönningstad) .. *(1948)* 178c
C-5 Polar (Widerøe) .. *(1951-52)* 162c
C-11 (Czechoslovakia) 129
C-11 "U" (Czechoslovakia) .. 129
C.35 Bonanza (Beechcraft) .. *(1952-53)* 175
C-44A (Grumman) .. .. *(1947)* 240c
C-45 (Beechcraft) .. *(1955-56)* 217
C-46R (Riddle) 354
C.47 Skytrain (Douglas) .. *(1951-52)* 234c
C-50 (Beechcraft) .. *(1955-56)* 216
C.54 Skymaster (Douglas) .. *(1956-57)* 277
C-54-GM (Canadair) .. *(1948)* 115c
C-69 (Lockheed) Constellation (1947) 252c
C.74 (Douglas) .. .. *(1951-52)* 226c
C-82 Packet (Fairchild) 294
C-97 Stratofreighter (Boeing) .. 260
C-97B Stratocruiser (Boeing) (1949-50) 197c

PAGE

C-102 (Avro Canada) .. *(1952-53)* 95
C-118 (Douglas) 293
C-118A (Douglas) .. *(1955-56)* 256
C-119 Packet (Fairchild) 294
C-121 Constellation (Lockheed) .. 318
C-123 (Chase) .. .. *(1953-54)* 213
C-123B Provider (Fairchild) .. 296
C-124 (Douglas) 283
C-125 Raider (Northrop) .. *(1951-52)* 277c
C-130 (Lockheed) 315
C-131 (Convair) 279
C-133A (Douglas) 282
C.449 (Nord) .. .. *(1948)* 150c
C.800 (Nord) .. .. *(1948)* 151c
C.3603 (Swiss Federal Aircraft Factory) (1948) 205c
C.3604 (Fédérale) .. *(1951-52)* 189c
CA.15 (Commonwealth) .. *(1948)* 111c
CA.17 (Commonwealth) .. *(1947)* 92c
CA-22 (Commonwealth) .. *(1954-55)* 112
CA-25 Winjeel (Commonwealth) .. 116
CA-27 Sabre (Commonwealth) .. 115
Ca. 191 (Caproni) .. *(1948)* 165c
Ca-193 (Caproni) .. *(1950-51)* 150c
C.A.B. (see Constructions Aéronautiques du Béarn) 144
C.A.P.1 (Companhia Aeronautica Paulista) .. .. *(1948)* 14c
C.A.P.4 (Companhia Aeronautica Paulista) .. .. *(1948)* 13c
C.A.P.4B Ambulancia .. *(1948)* 14c
C.A.P.4C Paulistinha Radio (1948) 14c
C.A.P.5 (Companhia Aeronautica Paulista) .. .. *(1948)* 13c
CASA (see Construcciones Aeronauticas S.A.) 228
CBY-3 Burnelli (C.C.F.) .. *(1947)* 96c
C.C.F. (see Canadian Car & Foundry Co., Ltd.) .. .. *(1955-56)* 114
CCW-5 (Custer) .. .. *(1956-57)* 263
CF-100 (Avro Canada) 119
CF-105 (Avro Canada) 118
C.F.A. (see Compagnie Francaise d'Aviation) .. .. *(1953-54)* 130
CH-1 (Cessna) 266
C.H.3 Series 2 and 3 Super Ace (Chrislea) (1951-52) 37c
C.H.3 Series 4 Skyjeep (Chrislea) (1951-52) 37c
CL-28 Argus (Canadair) 121
CL-44 (Canadair) 121
CL-106 (Canadair) 121
CL-107 (Canadair) 121
CL-329 (Lockheed) 315
CM 7 (Fouga) .. .. *(1951-52)* 125c
C.M. 8-R 9.8 Cyclone 1 (Fouga) (1951-52) 126c
C.M. 8-13 and 8-15 (Fouga) (1951-52) 125c
C.M.7 (Fouga) .. .. *(1951-52)* 125c
C.M. 8-13 (Fouga) .. *(1951-52)* 125c
C.M. 8-15 (Fouga) .. *(1951-52)* 125c
C.M.8.R-8.3 Midjet (Fouga) (1953-54) 135
C.M.8.R-9.8 Cyclope (Fouga) (1953-54) 136
C.M.8.R-13 Sylphe III (Fouga) (1954-55) 139
C.M. 10 (Fouga) .. *(1949-50)* 120c
C.M. 71 (Fouga) .. *(1954-55)* 130
C.M. 88-R Gemeaux (Fouga) (1953-54) 136
C.M. 100 and 101 (Fouga) .. *(1949-50)* 119c
C.M. 101-R (Fouga) .. *1952-53)* 116
C.M. 160 (Fouga) .. *(1956-57)* 140
C.M. 170M (Fouga) .. *(1956-57)* 140
C.M. 170-R Magister (Fouga) .. 150
C.M. 171 Makalu (Fouga) 151
C.M. 175 Magister Marine (Fouga) .. 151
C.M. 191 (Fouga) .. *(1956-57)* 140
C.M. 195 (Fouga) .. *(1956-57)* 140
C.M.A. (see Construzioni Meccaniche Aeronautiche S.P.A.) .. *(1948)* 165c
C.M. Jalon (Castel-Mauboussin) (1948) 143c
C.P. 30 (Piel) 162
CP-110 (Agusta) .. .. *(1952-53)* 136
CS2F (Grumman-D.H. Canada) .. 122
CS-102 (Czechoslovakia) 129
C.S.S. 10 (Poland) .. *(1953-54)* 173
C.S.S. 11 (Poland) .. *(1953-54)* 174
C.S.S. 12 (Poland) .. *(1956-57)* 193
C.S.S. 13 (Poland) .. *(1956-57)* 194
CT.10 (Nord) 161
CT.20 (Nord) 161
CV-130 Comet (Hockaday) .. *(1948)* 270c
C.V.V. (see Instituto di Aeronautica Politecnico de Milano) .. *(1951-52)* 154c
C.V.V.2 (S.A.I. Ambrosini) (1948) 173c
C.V.V.6 (S.A.I. Ambrosini) (1948) 173c
CW-32 (Curtiss) .. .. *(1948)* 244c
Caboré (I.P.T.) .. .. *(1951-52)* 14c
CALL AIRCRAFT COMPANY (U.S.A.) 262
CallAir (see Call Aircraft Company) 262
Call-Air Cadet .. .. *(1951-52)* 211c
Calquin (Instituto Aerotecnico) (1951-52) 9c
CAMAIR DIVISION OF CAMERON IRON WORKS, INC. U.S.A.) (1956-57) 246



Instrument Landing System

Annex 10 to The Convention of International Civil Aviation lays down that:—

"The standard non visual aid to final approach and landing shall be the I.L.S."

Pye I.L.S. conforms to the I.C.A.O. Standards. It is designed for unattended operation.

Localizer and Glide-path transmitters are duplicated.

Changeover is automatic in the event of transmitter failure.

Automatic Beam Control on Localizer and Glide-path ensure precise operation in all weather conditions.

Parabolic Localizer aerial system gives long range beam free from ambiguity bends and other site effects.

PYE
Telecommunications
CAMBRIDGE ENGLAND

Pye Telecommunications Distributors in 91 Countries ensure trouble-free service

PYE TELECOMMUNICATIONS LIMITED · CAMBRIDGE · ENGLAND

Phone: Teversham 3131 *Cables: Pyetelecom, Cambridge*

PAGE

Camair 480 246
Camel (Tupolev) 220
Camp (Antonov) 211
CANADAIR, LTD. (Canada) .. 120
Canadair Four .. .. *(1955-56)* 116
Canadair Five .. .. *(1955-56)* 117
CANADIAN CAR CO. LTD. (Canada) .. 122
Canberra (English Electric) .. 73
Canberra (Martin) .. *(1953-54)* 253
CAN-CAR (see Canadian Car & Foundry Co. Ltd) 122
CANCARGO AIRCRAFT MANUFACTURING CO., LTD. (Canada) *(1952-53)* 99
Canguru (Ambrosini) .. *(1950-51)* 148c
Canuck (Fleet) .. .. *(1947)* 101c
CANTINIEAU, JEAN (France) .. .. *(1953-54)* 142
Canuck (Avro, Canada) .. *(1951-52)* 99c
CAPITAL HELICOPTER CORP. (U.S.) .. .. *(1955-56)* 229
CAPRONI (see Aero Caproni Trento) *(1954-55)* 163
Caravan (Miles) 94
Caravelle (Sud) 165
Caribou (D.H. Canada) 122
Carioca (Companhia Aeronautica Paulista) .. .. *(1948)* 13c
CARMA MANUFACTURING COMPANY (U.S.A.) 262
Casmuniz 52 (Muniz) 47
Castel-Mauboussin (see Fouga) *(1948)* 143c
Cauré (C.N.N.A.) .. *(1949-50)* 11c
Centaurus-Fury (Hawker) .. *(1948)* 72c
CENTRAL-LAMSON CORP. (U.S.) *(1955-56)* 220
CENTRAL WORKSHOPS (Chile) *(1956-57)* 120
Centurion (Miles) 92
CESKOSLOVENSKE ZAVODY AUTOMOBILOVE A LETECKE (Czechoslovakia) 129
CESSNA AIRCRAFT CO., INC. (U.S.A.) 263
Cessna 140 .. .. *(1947)* 196c
Cessna 170 .. .. *(1956-57)* 248
Cessna 172 265
Cessna 180 266
Cessna 182 266
Cessna 190 .. .. *(1953-54)* 212
Cessna 195 222
Cessna 305 .. .. *(1955-56)* 231
Cessna 308 .. .. *(1953-54)* 210
Cessna 310 265
Cessna 318 263
Cessna 321 265
Cessna 620 263
Champion (Aeronca) .. *(1952-53)* 172
Champion 7EC .. .. *(1956-57)* 250
CHAMPION AIRCRAFT CORP. (U.S.) 267
CHANCE VOUGHT AIRCRAFT INC. (U.S.A.) 267
Chardonneret (Aérocentre) .. *(1948)* 134c
CHASE AIRCRAFT COMPANY INC. (U.S.A.) .. *(1954-55)* 225
Chickasaw (Sikorsky) 358
Chief (Aeronca) .. .. *(1947)* 178c
CHILTON AIRCRAFT CO., LTD. (G.B.) .. .. *(1952-53)* 49
Chincol (Fanaero) 128
Chipmunk (D.H. Canada) .. *(1955-56)* 121
Chipmunk T.10 (D.H.) .. *(1956-57)* 66
Choctaw (Sikorsky) 361
CHRISLEA AIRCRAFT CO., LTD. (G.B.) .. .. *(1951-52)* 37c
Chum (Aeronca) .. .. *(1947)* 177c
CIERVA (see Saunders-Roe) *(1951-52)* 73c
Cigale Major (Aubert) .. *(1956-57)* 127
Cigogne (Aubert) 138
Cijan C-3 Trojka (Yugoslavia) *(1951-52)* 293c
Clen Antu (Instituto Aerotecnico) *(1956-57)* 39
Clipper PA-16 (Piper) .. *(1949-50)* 269c
Cloudster (Douglas) .. *(1948)* 254c
Club (Aérocentre) .. *(1948)* 134c
Club (Aero-Jodel) 172
Club (Jodel) 154
Club-Air (Ercoupe) .. *(1951-52)* 236c
Coach (Ilyushin) 215
Coccinelle (SIPA) 163
Colibri (Instituto Aerotecnico) *(1951-52)* 9c
Colmar (Breguet) .. *(1953-54)* 119
COLONIAL AIRCRAFT CORPORATION (U.S.A.) 271
Colt (Antonov) 210
Comanche (Piper) 347
Comet (D.H.) 68
Comet (Hockaday) .. *(1948)* 270c
Commander 520 (Aero) .. *(1952-53)* 171
Commander 560 (Aero) 241
Commander 680 Super (Aero) .. 241

PAGE

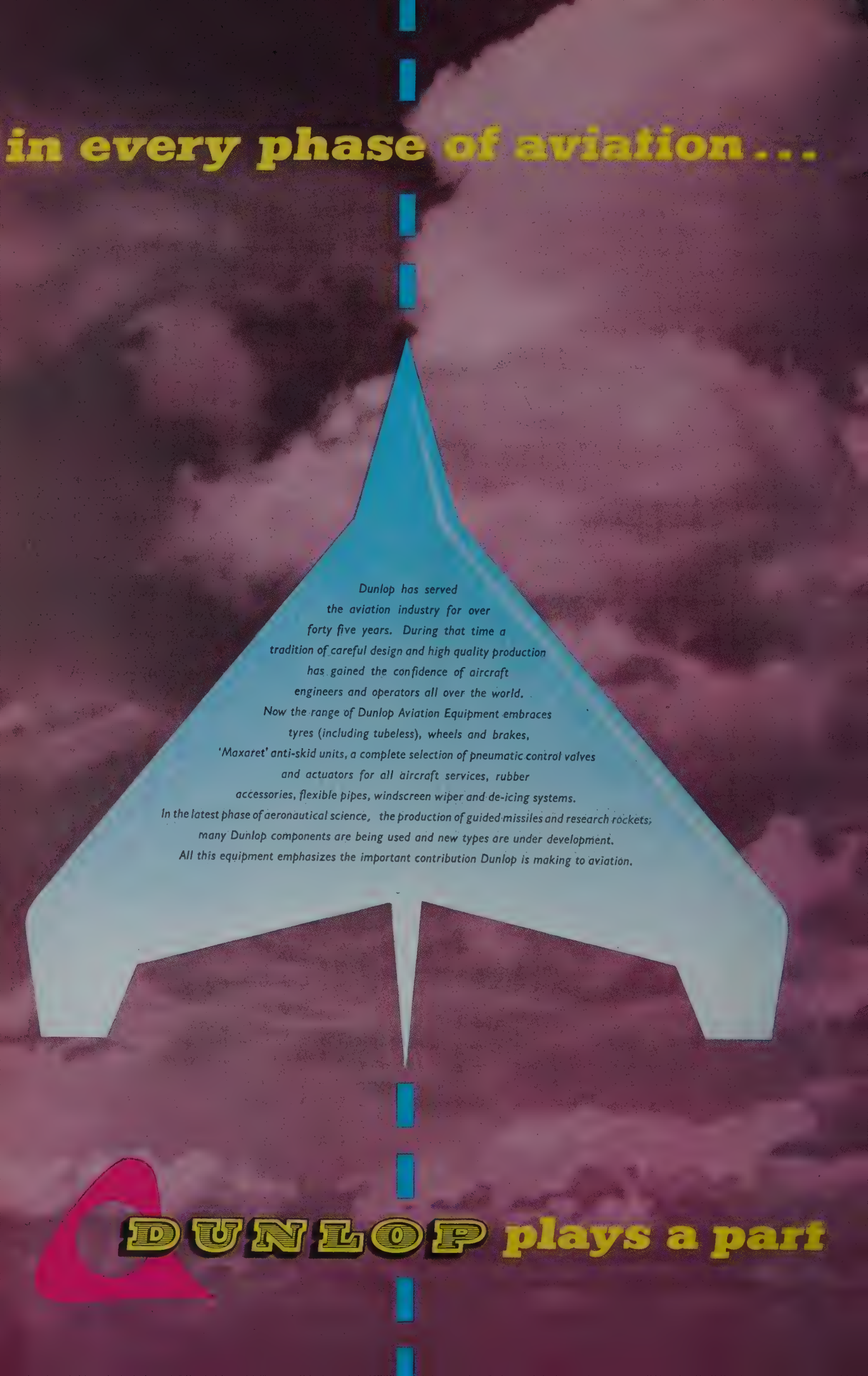
COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD. (Australia) 115
COMPAGNIE FRANCAISE D'AVIATION (France) .. *(1953-54)* 130
COMPANHIA NACIONAL DE NAVEGACAO AEREA (Brazil) *(1951-52)* 12c
Concordia (Cunliffe-Owen) .. *(1948)* 46c
Condor (Druine) 148
CONSOLIDATED VULTEE AIRCRAFT CORPORATION (U.S.A.) (see Convair) .. .. *(1955-56)* 236
Constellation (Lockheed) 318
Constitution (Lockheed) .. *(1950-51)* 245c
CONSTRUCCIONES AERONAUTICAS S.A. (Spain) 228
CONSTRUCTIONS AERONAUTIQUE DU BEARN (France) 144
CONSTRUCTIONS AERONAUTIQUES STAMPE ET RENARD S.A. (Belgium) 45
Consul (Airspeed) .. *(1950-51)* 16c
CONTINENTAL, INC. (U.S.A.) *(1952-53)* 209
CONVAIR DIVISION OF GENERAL DYNAMICS CORPORATION (U.S.) 271
Convair 440 277
Convair 880 276
Convair-Liner 240 278
Convair-Liner 340 278
Convertiplane (Bell) .. *(1955-56)* 219
Convertiplane (Jacobs) .. *(1955-56)* 280
Convertiplane (McDonnell) .. *(1955-56)* 286
Cork (Yakovlev) .. *(1956-57)* 207
Cormoran N.C. 211 (Aérocentre) *(1949-50)* 110c
Corsair F4U (Chance Vought) *(1952-53)* 188
Corse II (Sud-Ouest) .. *(1951-52)* 146c
Cougar (Grumman) 301
Courier (Helio) 306
Courlis (S.E.C.A.N.) .. *(1951-52)* 139c
Crate (Ilyushin) 214
Creek (Yakovlev) 223
Cri-Cri Major (C.F.A.) .. *(1950-51)* 122c
Crow (Yakovlev) .. .. *(1956-57)* 207
Cruisair (Bellanca) .. *(1952-53)* 180
Cruisemaster (Bellanca) .. *(1952-53)* 179
Cruisemaster (Northern) 343
Crusader (Chance Vought) .. 269
Cub Special (Piper) .. *(1948)* 310c
Culver Model V .. .. *(1947)* 209c
CURTISS AIRPLANE DIVISION CURTISS-WRIGHT CORPORATION (U.S.A.) .. *(1951-52)* 222c
CUSTER CHANNEL WING CORPORATION (U.S.A.) .. *(1956-57)* 263
Cutlass F7U (Chance Vought) .. 270
Cyclope I (Fouga) .. *(1951-52)* 126c
Cyclope III (Fouga) .. *(1953-54)* 136
Czapla (Poland) 207
CZECHOSLOVAK AUTOMOBILE & AIRCRAFT WORKS 129

D

D-1 (Larson) 313
D.5 Turbi (Druine) 148
D-7 Cri-Cri Major (C.F.A.) *(1950-51)* 122c
D.9 Bébé (Jodel) 153
D.9a (Aero-Jodel) 172
D.10 (Jodel) .. .. *(1950-51)* 127c
D.11 (Jodel) 153
D18C (Beechcraft) .. *(1948)* 219c
D.18S (Beechcraft) .. *(1955-56)* 217
D.31 Turbulent (Druine) 148
D35 (Beechcraft) .. .. *(1953-54)* 199
D50 Twin-Bonanza (Beechcraft) .. 246
D.60 Condor (Druine) .. *(1955-56)* 141
D.111 (Jodel) 153
D.112 (Aero-Jodel) 172
D.112 Club (Jodel) 154
D-117 Grand Tourisme (Normande) .. 162
D.120 (Wassmer) 172
D-558-I Skystreak (Douglas) *(1954-55)* 236
D-558-II Skyrocket (Douglas) *(1954-55)* 236
D.3803 (Flug and Fahrzeugwerke) *(1950-51)* 190c
DB-3F (Ilyushin) .. *(1947)* 159c
DC-3 (Douglas) .. .. *(1952-53)* 205
DC-4 (Douglas) .. .. *(1951-52)* 232c
DC-4M-1 and 2 (Canadair) *(1948)* 115c
DC-6 (Douglas) 293
DC-6A (Douglas) 293
DC-6B (Douglas) 293
DC-6C (Douglas) 293
DC-7 (Douglas) 291
DC-7B (Douglas) 291
DC-7C (Douglas) 291
DC-8 (Douglas) 289
DFS 8-346 (Russia) .. *(1954-55)* 188
D.H. (see de Havilland Aircraft Co., Ltd.) .. .. *(1955-56)* 64

PAGE

DH-4 (De Lackner) 281
D.H. 83C Fox Moth (D.H. Canada) *(1947)* 99c
D.H. 89 Dragon Rapide (de Havilland) *(1947)* 39c
D.H. 98 Mosquito (de Havilland) *(1950-51)* 52c
D.H. 100 Vampire (de Havilland) *(1954-55)* 65
D.H. 100 Sea Vampire (de Havilland) *(1954-55)* 65
D.H. 103 (de Havilland) .. *(1951-52)* 45c
D.H. 104 Devon (de Havilland) .. 70
D.H. 104 Dove (de Havilland) .. 70
D.H. 106 Comet (de Havilland) .. 68
D.H. 108 (de Havilland) .. *(1949-50)* 43c
D.H. 110 (de Havilland) 67
D.H. 112 Venom (de Havilland) .. 67
D.H. 113 Vampire Night Fighter (de Havilland) .. .. *(1954-55)* 66
D.H. 114 Heron (de Havilland) .. 66
D.H. 115 Vampire Trainer (de Havilland) 65
DHA-3 Drover (D.H. Australia) *(1953-54)* 109
DHA 5/42 (D.H. Australia) (1947) 94c
DHC-1 Chipmunk T. Mk. 10 (D.H.) *(1956-57)* 66
DHC-1 (Chipmunk D.H. Canada) *(1955-56)* 121
DHC-2 Beaver (D.H. Canada) .. 125
DHC-3 Otter (D.H. Canada) .. 123
DHC-4 Caribou (D.H. Canada) .. 122
D.L. 22 (Instituto Aerotecnico) (1951-52) 9c
D.L. 22-C (Instituto Aerotecnico) *(1951-52)* 10c
DM-6R (Yugoslavia) 374
Do 25 (Dornier) .. *(1956-57)* 201
Do 27 (Dornier) 173
Dakota (Douglas) .. .. *(1951-52)* 234c
Dart Herald (Handley Page) .. 83
Daru (Hungary) .. *(1956-57)* 168
DASSAULT, GENERALE AERONAUTIQUE MARCEL (France) .. 144
DE HAVILLAND AIRCRAFT CO., THE (G.B.) 65
DE HAVILLAND AIRCRAFT CO., OF NEW ZEALAND (N.Z.) *(1954-55)* 113
DE HAVILLAND AIRCRAFT OF CANADA LTD., THE (Canada) .. 122
DE HAVILLAND AIRCRAFT CO., (Pty.), LTD. (Australia) .. 116
DE HAVILLAND HOLDINGS, LTD. (G.B.) 64
DE SCHELDE, N.V. KONINKLIJKE MAATSCAPPIJ (Netherlands) *(1953-54)* 169
DE LACKNER HELICOPTERS, INC. (U.S.A.) 281
De Luxe Brigadier (Baumann) .. 243
Deauville (Sud Ouest) .. *(1950-51)* 144c
Defender (Aeronca) .. *(1945-46)* 199c
Defender (Fletcher) .. *(1956-57)* 280
Defiant (Boulton Paul) .. *(1945-46)* 21c
Delta 2 (Fairey) 76
Delta Dagger (Convair) 272
Delta Dart (Convair) 272
Delta Fighter (Sukhoi) .. *(1956-57)* 202
Deltaviex (Sud) 169
Demon (McDonnell) 329
Desford (Reid & Sigrist) .. *(1947)* 71c
Destroyer (Douglas) 287
Deux-Ponts (Breguet) 141
Devon (D.H.) 70
DITTMAR (see Möwe-Flugzeugbau Heini Dittmar) 173
DIVISION OF AIRCRAFT PRODUCTION, DEPARTMENT OF DEFENCE PRODUCTION (Australia) 114
Djinn (Sud) 170
DOMAN HELICOPTERS, INC. (U.S.A.) 281
DORNIER (see Flug & Fahrzengwerke *(1949-50)* 180c
DORNIER, OFICINAS TECHNICAS (Spain) .. .. *(1955-56)* 200
DORNIER-WERKE G.m.b.H. (Germany) 173
DOUGLAS AIRCRAFT CO. INC. (U.S.A.) 282
Dove (D.H.) 70
Dragon Rapide (D.H.) .. *(1947)* 39c
Dragonfly (Westland) 110
Draken (Saab) 233
Drone (Aviolanda) 157
Drone (Beechcraft) 247
Drone (Kaman) 311
Drone (Radioplane) 349
Drone (Temco) 367
Drover (D.H. Australia) .. *(1953-54)* 109
DRUINE, ROGER (France) .. 148
Duchess (Saunders Roe) .. *(1951-52)* 75c


in every phase of aviation . . .
Dunlop has served
the aviation industry for over
forty five years. During that time a
tradition of careful design and high quality production
has gained the confidence of aircraft
engineers and operators all over the world.
Now the range of Dunlop Aviation Equipment embraces
tyres (including tubeless), wheels and brakes,
'Maxaret' anti-skid units, a complete selection of pneumatic control valves
and actuators for all aircraft services, rubber
accessories, flexible pipes, windscreen wiper and de-icing systems.
In the latest phase of aeronautical science, the production of guided missiles and research rockets;
many Dunlop components are being used and new types are under development.
All this equipment emphasizes the important contribution Dunlop is making to aviation.
DUNLOP plays a part

PAGE

Duck GA-2 (Goodyear) .. *(1949-50)* 227c
Dumbo (G.C.A.) .. .. *(1951-52)* 158c
Durandal (Sud) 166

E

E.1/44 (Gloster) .. .. *(1949-50)* 56c
E.10/44 (Supermarine) .. *(1947)* 79c
E-12 (Hispano) 231
E-14 (Hispano) 232
E-35 Bonanza (Beechcraft) .. *(1954-55)* 208
E50 Twin-Bananza (Beechcraft) .. 246
E.114 Air Baby (Praga) .. *(1948)* 126c
E.117 (Praga) .. .. *(1948)* 126c
E.211 (Praga) .. .. *(1948)* 128c
EC-121 (Lockheed) .. *(1956-57)* 300
E.F. 100 (Eshelman) .. *(1948)* 256c
EF 150 Junkers (Russia) .. *(1954-55)* 188
E.P.9 (Edgar Percival) 71
Eagle 3 (Slingsby) 100
EAST COAST AERONAUTICS INC. (U.S.A.) .. *(1956-57)* 277
EDGAR PERCIVAL AIRCRAFT LTD. (G.B.) 71
EDO CORPORATION (U.S.A.) *(1951-52)* 235c
EGYPTIAN STATE AIRCRAFT FACTORY 134
EIDG. FLUGZEUGWERK (Switzerland) 238
EKLUND, TOROLF (Finland) .. 135
Eksperimental (Letalski) .. *(1954-55)* 301
El Boyero (Petrolini) .. *(1950-51)* 10c
Electra (Lockheed) 317
Emeraude (Piel) 166
EMIGH TROJAN AIRCRAFT COMPANY (U.S.A.) .. *(1951-52)* 235c
Emouchet (Minié) .. *(1951-52)* 139c
Emouchet-Escopette (Minié) .. *(1953-54)* 142
EMPRESA INDUSTRIAS AERONAUTICAS Y MECCANICAS DEL ESTADO (Argentine) .. *(1955-56)* 41
ENGINEERING & RESEARCH CORPORATION (U.S.A.) *(1954-55)* 245
ENGLISH ELECTRIC COMPANY LTD. (G.B.) 71
Ensign (All American) .. *(1948)* 215c
Eon (Elliotts) .. .. *(1950-51)* 54c
Epervier (Morane-Saulnier) .. 156
Epervier (Nord) .. .. *(1947)* 130c
ERCOUPE (see Engineering & Research Corporation) .. .. *(1954-55)* 245
Espadon (Sud-Ouest) .. *(1953-54)* 154
Essex Aero Sprite .. *(1948)* 59c
Estafette (Mignet) .. *(1953-54)* 43
Étendard II (Dassault) .. *(1956-57)* 134
Étendard IV (Dassault) 145
Étendard VI (Dassault) 145
Etabeta (G.C.A.) .. .. *(1954-55)* 166
Executive (On Mark) 347
Executive (Sparten) .. *(1949-50)* 278c
Executive (Stits) .. .. *(1955-56)* 316
Expeditor (Beechcraft) .. *(1955-56)* 217

F

F-1 Aircoupe (Forney) 297
F-1 Safari (Frye) 297
F-2 (Found) .. .. *(1949-50)* 101c
F2B (Boeing) .. .. *(1949-50)* 199c
F2G1 Corsair (Goodyear) .. *(1947)* 236c
F2H Banshee (McDonnell) .. *(1955-56)* 285
F2Y-1 Sea Dart (Convair) 253
F3D Skynight (Douglas) 238
F3H Demon (McDonnell) 329
F.4 (Ambrosini) .. .. *(1954-55)* 162
F4D Skyray (Douglas) 284
F4U Corsair (Chance Vought) *(1952-53)* 188
F.5 (Caproni) .. .. *(1954-55)* 163
F5D Skylancer (Douglas) 284
F-5G (Lockheed) .. .. *(1947)* 255c
F.6 (Pasotti) 190
F-6F-5 (Grumman) Hellcat *(1947)* 239c
F6U Pirate (Chance Vought) *(1950-51)* 213c
F.7 Rondone (Ambrosini) 184
F7F (Grumman) .. *(1948)* 265c
F7F-3N (Grumman) .. *(1947)* 238c
F7F-4N (Grumman) .. *(1947)* 238c
F7U (Chance Vought) 270
F.8L Falco (Aviamilano) 185
F8F Bearcat (Grumman) .. *(1949-50)* 229c
F8U (Chance Vought) 269
F.9 Sparviero (Pasotti) 191
F9F (Grumman) 301
F-11 (Fairchild, Canada) .. *(1947)* 100c
F11F (Grumman) 300
F.14 Nibbio (Aviamilano) 184
F-15A (Northrop) Reporter *(1947)* 276c
F.19 (Faucett) .. .. *(1947)* 155c
F.24 (Fairchild) .. .. *(1948)* 259c
F.25 Promotor (Fokker) .. *(1949-50)* 154c

PAGE

F.26 Phantom (Fokker) .. *(1947)* 154c
F-27 Friendship (Fairchild) .. 294
F.27 Friendship (Fokker) .. 198
F.35 Bonanza (Beechcraft) .. *(1955-56)* 215
F.47 (Fairchild) .. .. *(1948)* 259c
F.80 Shooting Star (Lockheed) *(1955-56)* 279
F-82 Twin Mustang (North American) *(1950-51)* 266c
F.84 (Republic) .. .. *(1955-56)* 309
F-84F (Republic) 353
F-86 Sabre (North American) .. 339
F-89 Scorpion (Northrop) 344
F-93 (North American) .. *(1951-52)* 271c
F-94 (Lockheed) .. .. *(1956-57)* 307
F-95 Sabre (North American) *(1950-51)* 262c
F-96 Thunderjet (Republic) *(1950-51)* 277c
F-100 Super Sabre (North American) 338
F-101 (McDonnell) 329
F-102 (Convair) 272
F.103 (Republic) .. .. *(1955-56)* 307
F.104 (Lockheed) 322
F-105 (Republic) 352
F.106 (Convair) 272
F.107A (North American) 338
F-110 McDonnell .. *(1953-54)* 251
Fa-2 (Yugoslavia) 375
FA-2 Airphibian (Fulton) .. *(1952-53)* 209
FB-1 Gyrodyne (Fairey) .. *(1949-50)* 52c
FBA 1A (Found) .. .. *(1951-52)* 105c
FBA-2 (Found) .. .. *(1952-53)* 101
F.D.1 (Fairey) .. .. *(1952-53)* 61
FD-1 (McDonnell) Phantom (1947) 258c
F.D. 2 (Fairey) .. .. *(1955-56)* 75
FD-25-B (Fletcher) .. .. *(1956-57)* 280
FES-530 (East Germany) 180
FFA (see FLUG & FAHRZEUGWERKE A.G.) 238
FG-10 (Goodyear) Corsair .. *(1947)* 235c
FH-1 Phantom (McDonnell) *(1950-51)* 252c
Fi 1 (Kockum) .. .. *(1948)* 199c
Fi 3 (Kockum) .. .. *(1948)* 199c
FJ Fury (North American) .. 341
F.L.3 (A.V.I.A.) .. *(1947)* 144c
F.L.3 (Lombardi) .. *(1949-50)* 147c
FL-23 (Fletcher) .. .. *(1951-52)* 239c
FL.53 (Meteor) 187
FL.54 (Meteor) 188
FL.55 (Meteor) 188
FL.55B (Meteor) 188
FN-333 (Nardi) 188
Fo.139 (Folland) .. *(1955-56)* 77
Fo.141 Gnat (Folland) 79
FP-80A (Lockheed) Shooting Star (1947) 249c
FR-1 Fireball (Ryan) .. *(1948)* 315c
FU-24 (Fletcher) 296
FABRICA MILITAR DE AVIONES (Argentine) 43
FABRICA NACIONAL DE AERONAVES (Chile) 128
FABRIQUE FEDERALE D'AVIONS (Switzerland) 238
Faceplate (Russia) 224
Fachiro (Partenavia) 189
Fagot (MIG) 217
FAIRCHILD ENGINE & AIRPLANE CORPORATION (U.S.A.) .. 294
FAIREY AVIATION CO., LTD. (G.B.) 75
FAIREY AVIATION COMPANY OF AUSTRALASIA PTY. LTD. (Australia) 116
FAIREY AVIATION CO. OF CANADA LTD. (Canada) .. 126
Falco (Aviamilano) 185
Family Cruiser PA-14 (Piper) *(1949-50)* 268c
FANAERO (see Fabrica Nacional de Aeronaves) (Chile) 128
Farfadet (Sud-Ouest) .. *(1955-56)* 163
FARMAN, SOCIÉTÉ ANONYME DES USINES (France) 149
Farmer (MIG) 216
FAWCETT AVIATION PTY., LTD. (Australia) 116
FEDERAL AIRCRAFT FACTORY (Switzerland) 238
FEDERALE (see Fabrique Fédérale d'Avions) .. .. *(1955-56)* 208
FIAT, SOCIETA PER AZIONI (Italy) 185
Finnmark (Honningstad) .. *(1952-53)* 147
Fireball (Ryan) .. .. *(1948)* 315c
Firebee (Ryan) 356
Firebrand (Blackburn) .. *(1951-52)* 27c
Firefly (Fairey) .. .. *(1956-57)* 71
Firefly T. Mk. 5 Trainer (Fairey, Australia) .. .. *(1955-56)* 112
Firefly Trainer (Fairey) .. *(1951-52)* 54c
Fishbed (Sukhoi) 219
Fishpot (Sukhoi) 219
Five (Canadair) .. .. *(1955-56)* 117
Flamant (Dassault) .. *(1954-55)* 137
Flashlight (Yakovlev) 222
FLEET MANUFACTURING LTD. (Canada) 126

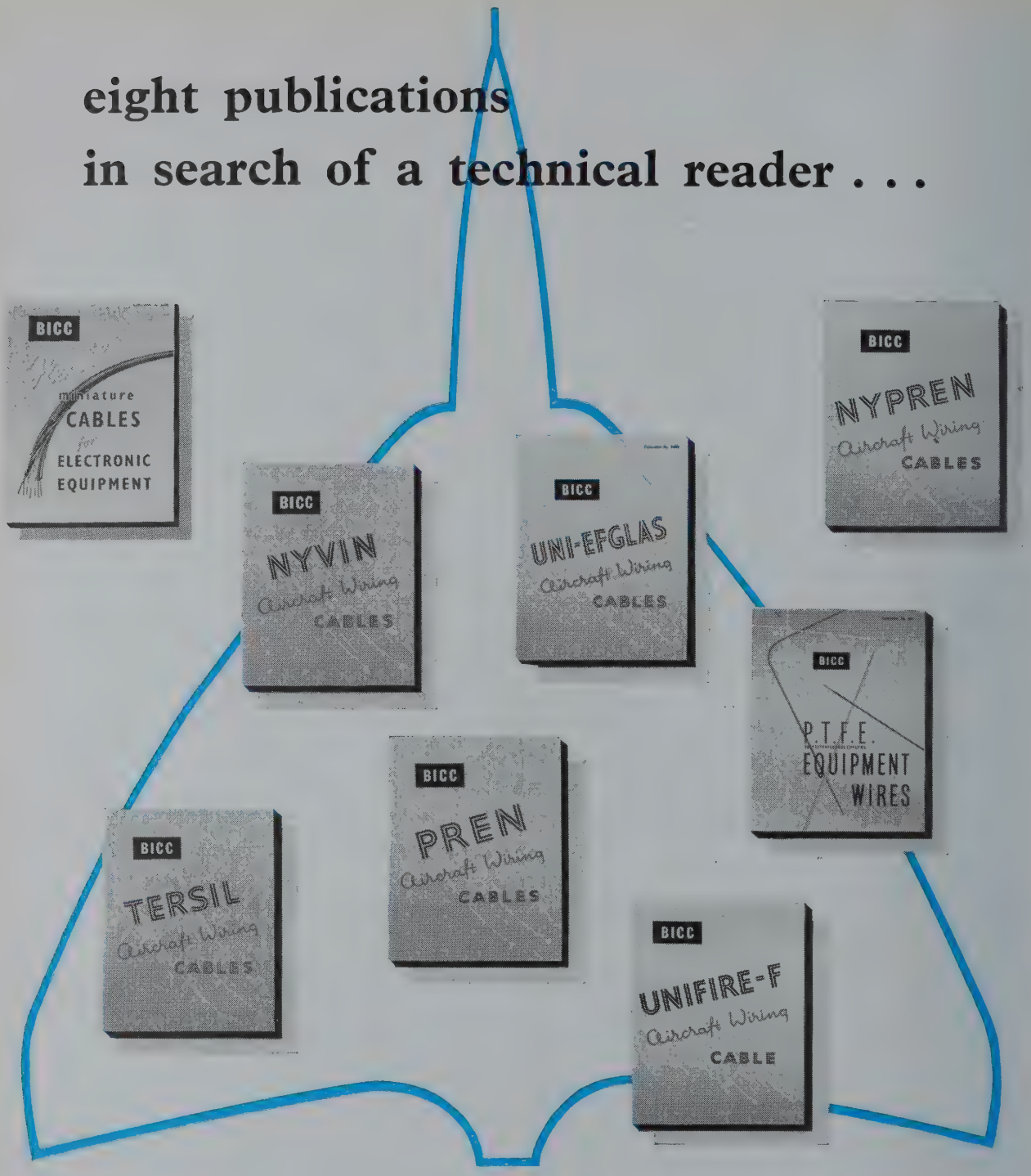
PAGE

FLETCHER AVIATION CORPORATION (U.S.A.) 296
Fleuret (Morane-Saulnier) .. *(1956-57)* 145
Flora (Yakovlev) .. .. *(1956-57)* 206
FLUG & FAHRZEUGWERKE A.G. (Switzerland) 238
Flut-R-Bug (Stits) 363
Flying Atar (SNECMA) 164
Flynng Automobile (Hall) .. *(1950-51)* 240c
Flying Boxcar (Fairchild) .. *(1954-55)* 246
Flying Platform (Hiller) 309
Flying Station Wagon (Stinson) *(1948)* 322c
Flying Wing (Northrop) .. *(1951-52)* 277c
FLYRIDE (see Glenview Metal Products Co. (U.S.) .. *(1956-57)* 281
FOCKE-WULF G.m.b.H. (Germany) .. 174
FOKKER (N.V. Koninklijke Nederlandsche Vliegtuigen-Fabriek Fokker) 197
FOKKER INDUSTRIA AERONAUTICA S.A. (Brazil) 46
FOLLAND AIRCRAFT LTD. (G.B.) 78
Fonceur (Sud) 167
FORNEY MANUFACTURING COMPANY (U.S.A.) 297
FOUGA (see Air-Fouga) 150
FOUND BROTHERS AVIATION LTD. (Canada) .. *(1952-53)* 101
Four Airliner (Canadair) .. *(1956-55)* 116
Fox Moth (D.H. Canada) .. *(1947)* 99c
Frégate (S.N.C.A.N.) .. *(1953-54)* 116
Freighter Type 170 (Bristol) *(1955-56)* 60
Freightship (Fokker) .. *(1953-54)* 169
Fresco (MIG) 216
Friendship (Fairchild) 294
Friendship F.27 (Fokker) 198
FRYE CORPORATION (U.S.A.) .. 297
FUJI JUKOGYO KABUSHIKI KAISHA (Japan) 194
Fulgur (Breguet) .. .. *(1951-52)* 118c
FULTON (see Continental Inc.) *(1952-53)* 209
FUNK AIRCRAFT COMPANY (U.S.A.) .. .. *(1955-56)* 234
Fury (Hawker) .. .. *(1951-52)* 66c
Fury Trainer (Hawker) .. *(1948)* 72c
Fury FJ-1 (North American) *(1949-50)* 259c
Fury FJ (North American) .. 341

G

G.11 E Gyroplane (Breguet) *(1949-50)* 117c
G.12 (Fiat) .. .. *(1950-51)* 150c
G17S (Beechcraft) .. *(1947)* 182c
G.26 (Fiat) .. .. *(1947)* 147c
G.41 Meteor (Gloster) .. *(1956-57)* 76
G.43 Meteor Trainer (Gloster) *(1951-52)* 58c
G-44A (Grumman) .. *(1948)* 268c
G.46 (Fiat) .. .. *(1956-57)* 174
G.47 Javelin (Gloster) .. *(1955-56)* 79
G.49 (Fiat) .. .. *(1956-57)* 174
G.51 (Grumman) .. .. *(1948)* 265c
G.55 (Fiat) .. .. *(1950-51)* 153c
G.56 (Fiat) .. .. *(1947)* 148c
G.58 Bearcat (Grumman) .. *(1949-50)* 229c
G.59 (Fiat) .. .. *(1956-57)* 173
G.61 (Fiat) .. .. *(1950-51)* 154c
G.63 Kitten (Grumman) .. *(1949-50)* 229c
G.64 Albatross (Grumman) .. 304
G.70 Guardian (Grumman) .. *(1949-50)* 229c
G.72 Kitten (Grumman) .. *(1949-50)* 229c
G-73 Mallard (Grumman) .. *(1951-52)* 246c
G.79 Panther (Grumman) .. *(1955-56)* 263
G.80 (Fiat) .. .. *(1955-56)* 168
G.81 (Fiat) .. .. *(1953-54)* 160
G.82 (Fiat) 186
G.82 Guardian (Grumman) .. *(1955-56)* 265
G-89 (Grumman) 302
G.91 (Fiat) 185
G-93 (Grumman) 301
G-98 (Grumman) 300
G.212 Aula Volante (Fiat) .. *(1951-52)* 156c
G.212 CP and TP (Fiat) .. *(1951-52)* 155c
G.218 (Fiat) .. .. *(1947)* 147c
GA.2 Duck Goodyear) .. *(1949-50)* 227c
G.A.5 (Gloster) 80
GA-22 (Goodyear) .. *(1952-53)* 210
GA-400R-3 Gizmo (Goodyear) .. 299
GA-447 (Goodyear) 298
G.A.L. 49 (General Aircraft) *(1947)* 46c
G.A.L. 56 (General Aircraft) *(1948)* 63c
G.A.L. 58 (General Aircraft) *(1947)* 47c
G.A.L. 60 (Blackburn) .. *(1949-50)* 30c
G.A.L. 61 (Blackburn) .. *(1949-50)* 31c
GB 2 Northrop .. .. *(1947)* 275c
GC 1A Globe Swift .. *(1947)* 234c
GC 1B Swift (Temco) .. *(1951-52)* 292c
G.C.A. (see Gruppo Construzioni Aeronautiche) .. .. *(1954-55)* 166
G.C.A. 1 Pedro (G.C.A.) .. *(1951-52)* 158c
G.C.A. 2 Dumbo (G.C.A.) .. *(1951-52)* 158c
G.C.A. 2A (Gyrodyne) .. *(1952-53)* 214
G.C.A. 2C (Gyrodyne) .. *(1954-55)* 255
G.C.A. 3 (Gyrodyne) .. *(1953-54)* 239

eight publications in search of a technical reader . . .



BICC

aircraft wiring cables

BRITISH INSULATED CALLENDER'S CABLES LIMITED
21, Bloomsbury Street, London W.C.1

These publications have been written for Aircraft Designers, to give them an idea of the range, construction and application of BICC Aircraft Wiring Cables. They are freely available on request.

No. 326: Flexible Miniature Cables for Electronic Equipment
No. 345: NYPREN Aircraft Wiring Cables
No. 350: PREN Aircraft Wiring Cables
No. 375: UNIFIRE-F Aircraft Wiring Cables
No 393: NYVIN Aircraft Wiring Cables
No. 394: TERSIL Aircraft Wiring Cables
No. 395: UNI-EFGLAS Aircraft Wiring Cables
No. 384: P.T.F.E. Equipment Wires

PAGE

G.C.A. 3 (G.C.A.) .. *(1954-55)* 166
G.C.A. 7 Helidyne (Gyrodyne) *(1951-52)* 247c
G.F.4 Rondone (Ambrosini) *(1952-53)* 138
G.I.L. Pegaz (Poland) .. *(1951-52)* 168c
G.I.L. Zurakowski Helicopter (Poland) *(1951-52)* 167c
G.L.3 (Sud-Ouest) .. *(1947)* 142c
GMP-1 (Flyride) .. *(1954-55)* 249
GMP-2 (Flyride) .. *(1956-57)* 281
GMP-2 (Flyride) 281
G.R. 17 (Fairey) .. *(1950-51)* 56c
GST (Russia) .. .. *(1947)* 161c
GY-20 (C.A.B.) .. .. *(1956-57)* 132
GY-30 (C.A.B.) .. .. *(1956-57)* 133
Gafanhoto (I.P.T.) .. *(1951-52)* 12c
GAIL AIRCRAFT ENGINEERING CO. (U.S.A.) 298
Gannet (Fairey) 76
Gargoyle (McDonnell) .. *(1947)* 259c
Gerfaut 1 (Nord) .. *(1956-57)* 147
Gerfaut 11 (Nord) .. *(1956-57)* 148
Gemeaux (Fouga) .. *(1953-54)* 136
Gemini (Miles) .. .. *(1948)* 79c
GENERAL AIRPLANE SERVICE (U.S.) .. .. *(1954-55)* 249
Gerfaut I (Nord) 158
Gerfaut II (Nord) 159
Gizmo (Goodyear) 299
GLENVIEW METAL PRODUCTS CO. (U.S.) .. .. *(1956-57)* 281
GLENN L. MARTIN CO. (U.S.A.) *(1956-57)* 313
Globe (see Temco) .. *(1948)* 323c
Globemaster 1 (Douglas) .. *(1951-52)* 226c
Globemaster 11 (Douglas) 283
GLOSTER AIRCRAFT CO., LTD. (G.B.) 80
Gloster Meteor Trainer .. *(1948)* 66c
Gloster Meteor .. .. *(1948)* 64c
Gloster E.1/44 .. .. *(1948)* 64c
Gnat (Folland) 79
Goeland (Nord) .. .. *(1948)* 150c
Gomhouria (Egypt) 134
GOODYEAR AIRCRAFT CORPORATION (U.S.A.) 298
Gorgan IV (Martin) .. *(1949-50)* 254c
Gouvernour (Sud) 170
GOVERNMENT FACTORIES (Australia) 114
GOVERNMENT WORKSHOPS (Portugal) 208
Grace (AICHI) .. .. *(1945-46)* 156c
Grand Tourisme (Normande) .. 162
Griffon (Nord) 158
Grifo S.1001 (Ambrosini) .. *(1951-52)* 152c
Grillon (Aubert) 129
Grognard S.E. 2410 (Sud-Est) *(1952-53)* 130
GRUMMAN AIRCRAFT ENGINEERING CORPORATION (U.S.A.) 299
GRUPPO CONSTRUZIONI AERONAUTICHE (Italy) .. *(1954-55)* 166
Guardian (Grumman) .. *(1955-56)* 265
Guion (Hispano) 230
Gulfstream (Grumman) 299
Gull 4 (Slingsby) .. *(1953-54)* 93
Gyro-Boat (Bensen) 253
Gyro-Copter (Bensen) 253
Gyro-Glider (Bensen) 252
Gyrodyne (Jacobs) .. *(1955-56)* 280
Gyrodyne (Fairey) .. *(1949-50)* 52c
GYRODYNE COMPANY OF AMERICA, INC. (U.S.A.) 305
Gyroplane (Breguet) .. *(1952-53)* 112

H

H-2 (SOBEH) .. .. *(1955-56)* 184
H-2 (Landgraf) .. .. *(1949-50)* 236c
H-2 (N.H.I.) .. .. *(1956-57)* 191
H-3 (N.H.I.) 201
H-4 (Sikorsky) .. .. *(1949-50)* 277c
H-5 (Sikorsky) .. .. *(1954-55)* 292
H-10 (Atlas) .. .. *(1949-50)* 189c
H-12 (Bell) .. .. *(1953-54)* 178
H-13 (Bell) 250
H-13D (Bell) .. .. *(1951-52)* 201c
H-13G (Bell) .. .. *(1955-56)* 220
H-13J (Bell) 251
H-19 (Sikorsky) 358
H-21 (Vertol) 371
H-23 (Hiller) 308
H-25A (Vertol) 370
H-31 (Doman) 281
H-34 (Sikorsky) 361
H35 Bonanza (Beechcraft) .. 244
H-37 (Sikorsky) 360
H-39 (Sikorsky) .. .. *(1955-56)* 314
H-391B (Helio) 306
H-392 (Helio) 307
H.A.001 (Hollandair) 200
HA-43 (Hispano) .. *(1955-56)* 201
HA-44-B1 (Hispano) .. *(1950-51)* 181c
HA-100 (Hispano) 231

PAGE

HA-200-R1 (Hispano) 232
HA-231-R1 (Hispano) 230
HA-1109 Buchon (Hispano) .. 230
HA-1109 JL (Hispano) .. *(1951-52)* 182c
HC-1 (Doman Frasier) .. *(1948)* 245c
HC-2 Heli-Baby (Czechoslovakia) .. 132
H.D.10 (Hurel-Dubois) .. *(1951-52)* 127c
H.D.31 (Hurel-Dubois) .. *(1954-55)* 140
H.D.32 (Hurel-Dubois) .. *(1955-56)* 144
H.D.34 (Hurel-Dubois) 152
H.D.35 (Hurel-Dubois) .. *(1955-56)* 144
H.D.45 (Hurel-Dubois) .. *(1954-55)* 141
H.D.321 (Hurel-Dubois) 152
HD 153 Möwe (Dittmar) 173
HD 156 Möwe (Dittmar) 173
HDM.105 (Miles) 93
HDM.106 Caravan (Miles) 94
HDM.107 Aerojeep (Miles) .. 94
H.F. XX-02 (Chile) .. *(1956-57)* 120
HFB 209 (Hamburger) 174
HJ-1 Hornet (Hiller) 307
HK-1 (Heinonen) 135
HK-2B (Fuji) .. .. *(1955-56)* 177
HL-1 Series B (C.N.N.A.) *(1951-52)* 12c
HL-3 Series (C.N.N.A.) .. *(1949-50)* 11c
H.M.1 (AISA) .. .. *(1951-52)* 180c
H.M.2 (AISA) .. .. *(1951-52)* 180c
H.M.3 (AISA) .. .. *(1951-52)* 180c
H.M.5 (AISA) .. .. *(1951-52)* 180c
H.M.7 (AISA) .. .. *(1951-52)* 180c
H.M.9 (AISA) .. .. *(1951-52)* 181c
H.M.310 (Mignet) .. *(1953-54)* 43
HNS-1 (Sikorsky) .. *(1949-50)* 277c
HO2S-1 (Sikorsky) .. *(1949-50)* 278c
HO3S-1 (Sikorsky) .. *(1954-55)* 292
HO4S-1 (Sikorsky) 358
HO5S-1 (Sikorsky) .. *(1954-55)* 274
HOE-1 (Hiller) 307
HOK-1 (Kaman) 311
H.P.67 Hastings (Handley Page) *(1954-55)* 78
H.P.70 Halton (Handley Page) *(1947)* 51c
H.P.75 Manx (Handley Page) *(1947)* 52c
H.P.80 Victor (Handley Page) .. 82
H.P.81 Hermes 4 (Handley Page) *(1953-54)* 79
H.P.82 Hermes 5 (Handley Page) *(1952-53)* 68
H.P.97 (Handley Page) .. *(1953-54)* 77
H.P.R.2 (Handley Page) .. *(1951-52)* 62c
H.P.R.3 Herald (Handley Page) .. 83
H.P.R.5 (Handley Page) .. *(1955-56)* 84
HRP (Vertol) .. .. *(1956-57)* 345
HRS (Sikorsky) 358
HR2S-1 (Sikorsky) 360
HS-42-B (Hispano) .. *(1949-50)* 174c
HSL (Bell) 252
HSS-1 (Sikorsky) 361
HT-2 (Hindustan) 127
HT-10 (Hindustan) .. *(1954-55)* 122
HTE (Hiller) 308
HTK-1 (Kaman) 311
HTL (Bell) 250
HTL 6 (Bell) .. .. *(1955-56)* 220
HTL-7 (Bell) 251
HU2K-1 (Kaman) 311
HUL (Bell) 251
HUP Retriever (Vertol) 370
HUS-1 (Sikorsky) 361
Halcon (CASA) 229
Halton (Handley Page) .. *(1948)* 70c
HAMBURGER FLUGZEUGBAU G.m.b.H. (Germany) 174
Hamilcar (General Aircraft) *(1947)* 46c
Hamilcar (General Aircraft) *(1947)* 47c
HANDLEY PAGE LTD. (G.B.) .. 81
HANDLEY PAGE (READING) LTD. (G.B.) 81
Hare (Mil') 218
Harvard (North American) .. *(1948)* 304c
Hastings (Handley Page) 84
HAWKER AIRCRAFT LTD. (G.B.) 85
HAWKER AIRCRAFT (BLACKPOOL) LTD. (G.B.) 85
HAWKER SIDDELEY GROUP LTD. (G.B.) 87
HAYDEN AIRCRAFT CORP. (U.S.A.) 306
HEINKEL, ERNST, FAHRZEUGBAU G.m.b.H. (Germany) .. 174
HEINON, JUHANI (Finland) .. 135
Helidyne (Gyrodyne) .. *(1953-54)* 239
Heli-Vector (De Lackner) .. *(1955-56)* 246
Hellcat (Grumman) .. *(1947)* 239c
Heli-Baby (Czechoslovakia) .. 132
HELIO AIRCRAFT CO. (U.S.A.) .. 306
HELIOPLANE (see Helio Corporation) *(1951-52)* 248c
HENSCHEL UND SOHN G.m.b.H. (Germany) .. .. *(1956-57)* 165
Herald (Handley Page) 83
Hercules (Lockheed) 315
Hermes 4 (Handley Page) .. *(1953-54)* 79
Hermes 5 (Handley Page) .. *(1953-54)* 68
Heron (D.H.) 66

PAGE

HESTON AIRCRAFT CO., LTD. (G.B.) .. .. *(1951-52)* 69c
HILLER HELICOPTERS, INC. (U.S.A.) 307
Hiller 360 (United Helicopters) *(1948)* 269c
HINDUSTAN AIRCRAFT PRIVATE LTD. (India) 127
HISPANO AVIACION S.A. LA (Spain) 230
Hodek (Czechoslovakia) .. *(1948)* 128c
Holiday (Starck) .. .. *(1953-54)* 149
HOLLANDAIR T.B. (Netherlands) .. 200
HOLSTE, AVIONS MAX (France) .. 156
Honey Bee (Bee) .. *(1955-56)* 215
HONNINGSTAD (see Norsk Flyindustri S/A) .. .. *(1955-56)* 184
Honza (Czechoslovakia) .. *(1949-50)* 107c
Hoppi-copter C-1 (Capital) .. *(1955-56)* 229
HOPPI-COPTERS INC. (see Capital) *(1954-55)* 220
Hornet (D.H.) .. .. *(1951-52)* 45c
Hornet (Hiller) 307
Horse (Yakovlev) 222
Hound (Mil) 219
Hoverfly (Sikorsky) .. *(1949-50)* 277c
HOWARD AERO INC. (U.S.A.) .. 309
HUGHES AIRCRAFT CO. (U.S.A.) *(1955-56)* 85
HUGHES TOOL COMPANY, AIRCRAFT DIVISION (U.S.A.) .. 310
Hunter (Hawker) 85
HUNTING PERCIVAL AIRCRAFT LTD. (G.B.) 87
HUREL-DUBOIS SOCIÉTÉ DE CONSTRUCTION DES AVIONS (France 151
Husky (Fairchild, Canada) .. *(1947)* 100c
Hustler (Convair) 274
Hydro-Glider (Bensen) 253

I

I-11 (AISA) .. .. *(1955-56)* 198
I-11B (AISA) 227
I-115 (AISA) 227
I.A. (see Fabrica Militar de Aviones) (Argentine) 43
I.A.M.E. (see Empresa Industrias Aeronauticas y Meccanicas del Estado) *(1955-56)* 41
I.A.R. 811 (Rumania) .. *(1953-54)* 150
I.Ae.24 Calquin (Instituto Aerotecnico) *(1951-52)* 9c
I.Ae.27 Pulqui 1 (Instituto Aerotecnico) *(1951-52)* 8c
I.Ae.30 Namcu (Instituto Aerotecnico) *(1951-52)* 7c
I.Ae.31 Colibri (Instituto Aerotecnico) *(1951-52)* 9c
I.A.33 Pulqui 11 (Instituto Aerotecnico) *(1956-57)* 40
I.A.34 Clen Antu (Instituto Aerotecnico) *(1956-57)* 39
I.A.35 (Instituto Aerotecnico) .. 44
I.A.37 (Instituto Aerotecnico) .. 43
I.A.41 (Urubu) .. .. *(1956-57)* 39
I.A.45 (Instituto Aerotecnico) .. 43
I.A.46 (Instituto Aerotecnico) .. 43
I.A.R.811 (Rumania) 208
I.A.R.813 (Rumania) 208
I.A.R.814 (Rumania) 208
I.A.R.817 (Rumania) 208
I.Ae.DL.22 (Instituto Aerotecnico) *(1951-52)* 9c
I-G (Transcendental) .. *(1956-57)* 344
IL-2 (Ilyushin) .. .. *(1949-50)* 163c
IL-4 (Ilyushin) .. .. *(1947)* 160c
IL-10 Shturmovik (Ilyushin) *(1955-56)* 191
IL-11 (Ilyushin) .. *(1950-51)* 168c
IL-12 (Ilyushin) 214
IL-14 (Ilyushin) 214
IL-14P (East Germany) 179
IL-18 (Ilyushin) 214
IL-20 (Ilyushin) 214
IL-28 (Ilyushin) 213
IL-28U (Ilyushin) 214
IM-99 Bomarc (Boeing) 261
IP-2 (Iberavia) .. .. *(1951-52)* 183c
I.P.T. (see Instituto de Pesquisas Tecnologicas) 46
I.P.T. 0 Bichinho .. *(1951-52)* 12c
I.P.T. 1 Gafanhoto .. *(1951-52)* 12c
I.P.T. 2 Aratinga .. *(1951-52)* 12c
I.P.T. 3 Saracura .. *(1951-52)* 12c
I.P.T. 4 Planalto .. *(1951-52)* 12c
I.P.T. 5 Jaraguá .. *(1951-52)* 12c
I.P.T. 6 Stratus .. *(1951-52)* 13c
I.P.T. 7 Junior .. .. *(1951-52)* 13c
I.P.T. 8 .. .. *(1951-52)* 13c
I.P.T. 9 .. .. *(1951-52)* 13c
I.P.T. 10 Junior .. .. *(1951-52)* 13c
I.P.T. 11 Bivhão .. *(1951-52)* 13c
I.P.T. 12 Caboré .. *(1951-52)* 14c
I.P.T. 13 .. .. *(1951-52)* 14c



CONVAIR 880: World's Fastest Jet Passenger Plane!

Racing with the sun at 615 miles an hour, Convair's 880 Jet-Liner will cut your travel time in half! The only jet transport designed to operate from hundreds of existing airports, it will bring silent, vibrationless flight to travelers everywhere . . . big cities and small.

Convair's 880 Jet-Liner, powered by General Electric CJ-805 engines, will be delivered to leading airlines* for world-wide service beginning in 1959. In this new era of jet transportation, Convair's luxurious 880 Jet-Liner will be the world's fastest passenger plane—truly master of the skies!

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

*AMONG AIRLINES TO FIRST OFFER CONVAIR 880 JET-LINER SERVICE WILL BE TWA • Delta • TRANSCONTINENTAL S.A. *(Argentina)*

	PAGE
I.P.T. 14 Marréco .. *(1951-52)*	14c
I.P.T. 16 and 17	46
IS-1 Sep (Poland) .. *(1953-54)*	174
IS-2 Mucha (Poland) .. *(1953-54)*	174
IS-3 ABC (Poland)	206
IS-4 Jastrzab (Poland) .. *(1953-54)*	174
IS-5 Kaezka (Poland) .. *(1951-52)*	168c
IS-6-X Nietoperz (Poland) .. *(1953-54)*	174
IBERAVIA S. A. (Spain) *(1954-55)*	195
Ikarus (Yugoslavia)	373
ILYUSHIN, SERGEI (Russia) ..	212
Ilyushin Jet-propelled Bomber (Ilyushin) *(1948)*	182c
INDONESIAN AIR FORCE, TECHNICAL STAFF .. *(1955-56)*	165
INDRAERO, SOCIÉTÉ (France) *(1956-57)*	141c
Industriewerk IL-14P (East Germany)	179
Inflatable (Goodyear) .. *(1956-57)*	283
Inflatoplane (Goodyear)	298
Inta H.M.1 (AISA) .. *(1951-52)*	180
Inta H.M.2 (AISA) .. *(1952-53)*	180
Inta H.M.3 (AISA) .. *(1952-53)*	180
Inta H.M.5 (AISA) .. *(1952-53)*	180
Inta H.M.7 (AISA) .. *(1952-53)*	180
Inta H.M.9 (AISA) .. *(1952-53)*	181
INSTITUTE OF SCIENCE AND TECHNOLOGY (Philippines) ..	202
INSTITUTE OF TECHNICAL RESEARCH (Brazil)	46
INSTITUTO AEROTECNICO (Argentine Republic) (see FABRICA MILITAR DE AVIONES) ..	43
INSTITUTO DE PESQUISAS TECNOLOGICAS (Brazil)	46
INSTITUTO DI AERONAUTICA POLITECNICO DI MILANO (Italy) .. .. *(1951-52)*	154c
INSTRUMENTS DE PRECISION M.D.G. (France) .. *(1951-52)*	130c
Inta (see AISA) .. *(1951-52)*	180c
Integral (Breguet) .. *(1956-57)*	129
Iroquois (Bell)	249

J

J/1 Autocrat (Auster) .. *(1955-56)*	50
J1N Alpha (Auster)	52
J/1 Helicopter (McDonnell) *(1950-51)*	253c
J/2 Arrow (Auster) .. *(1951-52)*	20c
J-2-L1 Jupiter (Jamieson) *(1951-52)*	250c
J/4 (Auster) .. .. *(1951-52)*	20c
J/5 Autocar (Auster)	53
J5C (Piper) Super-Cruiser *(1947)*	280c
J/5E Aiglet Trainer (Auster) ..	52
J21A (Saab) .. .. *(1951-52)*	187c
J21RA and RB (Saab) .. *(1951-52)*	186c
J-22 Single-seat Fighter Monoplane *(1947)*	165c
J29 (Saab)	236
J35 (Saab)	233
J32 Lansen (Saab)	234
J.C.1 (S.N.C.A.C.) .. *(1947)*	116c
J.D.M. AVIONS (France) *(1951-52)*	127c
JOV-3 .. .. *(1950-51)*	243c
JRF-5 Goose (Grumman) .. *(1947)*	240c
JR2F-1 Albatross (Grumman) *(1949-50)*	230c
JRM-1 and -2 Mars (Martin) *(1951-52)*	267c
Jac (Starck) .. .. *(1948)*	155c
Jack (Mitsubishi) .. *(1945-46)*	162c
JACKAROO AIRCRAFT LTD. (G.B.)	91
JACOBS AIRCRAFT ENGINE CO. (U.S.A.) .. .. *(1956-57)*	292
Jaguar (Grumman) .. *(1953-54)*	235
Jalon (Fouga) .. .. *(1949-50)*	120c
JAMIESON AIRCRAFT COMPANY INC. (U.S.A.) .. *(1951-52)*	250c
Jaragua (I.P.T.) .. *(1951-52)*	12c
Jaskolka (Poland)	207
Jastrzab (Poland) .. *(1953-54)*	174
Javelin (Gloster)	80
Javelot (Wassmer) .. *(1956-57)*	162
Jet Gyrodyne (Fairey) .. *(1956-57)*	73
Jet Mentor (Beechcraft)	246
Jet Provost (Hunting Percival) ..	87
Jetliner C.102 (Avro Canada) *(1952-53)*	95
Jetstar (Lockheed)	315
Jindivik (Australia)	114
JODEL, SOCIÉTÉ DES AVIONS (France)	153
Jodel-Wassmer D.120 (Wassmer) ..	171
JURCA (France)	154
Junak (Poland)	203
Junior (I.P.T.) .. .. *(1951-52)*	13c
Junior (Avions Fairey) .. *(1951-52)*	11c
JUNKERS FLUGZEUG-UND MOTORENWERKE G.m.b.H. (Germany)	174
Jupiter (Jamieson) .. *(1951-52)*	250c

K

K.17 Vertolet (Kamov) .. *(1955-56)*	191
K-125-A (Kaman) .. *(1948)*	273c
K-190 (Kaman) .. .. *(1949-50)*	236c
K-225 (Kaman) .. .. *(1953-54)*	243
K-600 (Kaman)	312
KA-10 (Kamov)	216
KA-15 (Kamov)	216
KA-18 (Kamov)	216
KAL-2 (Kawasaki) .. *(1956-57)*	183
KAQ-1 (Kawasaki) .. *(1955-56)*	178
KAT-1 (Kawasaki) .. *(1956-57)*	183
KB-6 (Yugoslavia)	376
KB-9 (Letalski) .. .. *(1954-55)*	301
KC-97 (Boeing)	261
KC-135 Stratotanker (Boeing) ..	255
KD2R (Radioplane)	350
KDA-1 (Ryan)	356
KDD-1 (McDonnell) Kadydid *(1947)*	259c
KDM-1 Plover (Martin) .. *(1953-54)*	229
KDN-1 Target Drone .. *(1947)*	265c
KH-2 (Kellett) .. .. *(1948)*	274c
KH-8 (Kellett) .. .. *(1948)*	273c
KH-15 (Kellett)	313
Kl.107 (Klemm)	175
KSD-1 (McDonnell) Gargoyle *(1947)*	259c
KTS-20 (Tsibin) .. *(1952-53)*	155
KZ (see Skandinavisk Aero Industri	
KA/S	134
KZ A.O.P. (KZ) .. .. *(1951-52)*	112c
KZ II-T (KZ) .. .. *(1949-50)*	108c
KZ III (KZ) .. .. *(1947)*	111c
KZ IV (KZ) .. .. *(1947)*	112c
KZ VII Lark (KZ) .. *(1956-57)*	127
KZ VIII (KZ) .. *(1951-52)*	113
KZ X (KZ) .. .. *(1955-56)*	127
Kaczka (Poland) .. .. *(1951-52)*	168c
KAMAN AIRCRAFT CORPORATION (U.S.A.)	310
KAMAN AIRCRAFT OF CANADA, LTD.	126
KAMOV, N.I. (Russia)	216
Kania (Poland)	204
Kanya (Aero-Ever) .. *(1952-53)*	149
Kanya (Hungary) .. *(1956-57)*	168
Karhu 48 (Karhumaki) .. *(1954-55)*	127
Karhu 48B (Karhumaki) .. *(1955-56)*	128
Karhu 49 (Karhumaki) .. *(1953-54)*	123
KARHUMAKI (see Veljekset Karhumaki O/Y) .. .. *(1955-56)*	128
Katy (Payen)	162
KAWASAKI KOKUKI K.K. (Japan)	194
Kek Madar (Hungary) .. *(1956-57)*	168
KELLETT AIRCRAFT CORPORATION (U.S.A.)	312
KINGSFORD SMITH AVIATION SERVICE PTY., LTD. (Australia)	117
Kirby Cadet (Slingsby) .. *(1954-55)*	96
Kirby Tutor (Slingsby)	101
Kitten (Grumman) .. *(1949-50)*	229c
KLEMM, HANS, FLUGZEUGBAU G.m.b.H. (Germany)	175
Kmotr L.G.30 (Czechoslovakia) *(1951-52)*	108c
Kolibrie (N.H.I.)	201
KONINKLIJKE NEDERLANDSCHE VLIEGTUIGEN-FABRIEK FOKKER (Netherlands) .. *(1955-56)*	182
Kotlinski Trzmiel (Poland) ..	206
KOVO LIMITED (Czechoslovakia) *(1951-52)*	108c
Krajanek (Czechoslovakia) .. *(1949-50)*	107c
KUPFER, M.A. (Russia) *(1953-54)*	177
Kurir (Yugoslavia)	374
KUZAKOV, M.A. (Russia)	216

L

L-10B (Philippine) .. *(1955-56)*	185
L-13 Blanik (Convair)	133
L-16 (Aeronca) .. .. *(1950-51)*	197c
L-17 Navion (Ryan) .. *(1952-53)*	242
L-M (Philippines) .. *(1956-57)*	192
L-18 (Piper) .. .. *(1955-56)*	303
L-19 Bird Dog (Cessna)	264
L-19A (Cessna) .. .. *(1956-57)*	247
L-20 Beaver (D.H. Canada) ..	125
L-21 (Piper) .. .. *(1955-56)*	303
L-23 (Beechcraft)	246
L-23B (Beechcraft) .. *(1956-57)*	231
L26 (Aero)	241
L-26C (Aero)	241
L-27A (Cessna)	265
L-40 Meta-Sokol (Czechoslovakia) ..	130
L-60 Brigadier (Czechoslovakia) ..	130
L.101 (Czechoslovakia) .. *(1952-53)*	105
L.101 Air Tractor (Lamson) ..	313
L.107 Lunak (Czechoslovakia) *(1952-53)*	104
L-208 (Czechoslovakia)	129
L.290 Orel (Czechoslovakia) *(1952-53)*	105
L.3805 Commander (Aero) .. *(1953-54)*	195
LA-5 (Lavochkin) .. *(1948)*	187
LA-7 (Lavochkin) .. *(1949-50)*	165c
LA-9 (Lavochkin) .. *(1953-54)*	177
LA-11 (Lavochkin) .. *(1954-55)*	183
La-16 Lerche (East Germany) ..	179
La-17 (East Germany)	179
LA-17 (Lavochkin) .. *(1954-55)*	183
LAGG-3 (Russia) .. *(1947)*	157c
LAZ-7 (Lazarow)	128
LAZ-8 (Lazarow)	128
LAZ-10H (Lazarow)	128
LC-126A (Cessna) .. *(1954-55)*	222
LD.26 (M.D.G.) .. *(1948)*	142c
LD-40 (Czechoslovakia)	130
LD.45 (M.D.G.) .. *(1947)*	121c
LF 109 Pionyr (Czechoslovakia) *(1954-55)*	125
LG30 Kmotr (Czechoslovakia) *(1951-52)*	108c
LG 125 Sohaj 2 (Czechoslavakia) *(1953-54)*	120
LK-1 (Yugoslavia)	376
LK-108 (TE-4A) Laister-Kauffmann *(1947)*	245c
LI-2 (Russian DC-3) .. *(1948)*	195c
LM-1 (Fuji)	194
L.M.5 (Lombardi) .. *(1949-50)*	147c
LOM-55 Libelle (East Germany) ..	180
L.M.7 (Lombardi) .. *(1950-51)*	155c
LS-50 (Legrand-Simon)	155
L-Spatz-55 (Scheibe)	177
LWD Junak (Poland)	203
LWD Zuraw (Poland)	203
LZ-1A (Doman) .. *(1949-50)*	213c
LZ-2A Pelican (Doman) .. *(1949-50)*	213c
LZ-4A (Doman) .. .. *(1952-53)*	197
LZ-5 (Doman)	281
Laister-Kauffman Baby Albatross Glider .. .. *(1947)*	245c
LAMSON AIRCRAFT CO., INC. (U.S.A.)	313
Lancastrian (Avro) .. *(1948)*	29c
Landmann La-16 Lerche (East Germany)	179
Landmann La-17 (East Germany) ..	179
Langley Twin-Four .. *(1948)*	276c
Languedoc (Sud-Est) .. *(1951-52)*	143c
Lansen (Saab)	234
Lark (KZ) .. .. *(1955-56)*	127
LARSON AERO DEVELOPMENT (U.S.A.)	313
LATECOERE SOCIETE INDUSTRIELLE D'AVIATION (France) *(1951-52)*	129c
Latécoere 631 .. .. *(1948)*	141c
LAVOCHKIN, SEMYON A (Russia) *(1954-55)*	183
LAZAROW, ENG. CWIETAN (Bulgaria)	128
LEAR, INC. (U.S.A.)	314
Learke (Skandinavisk Aero Industri) *(1948)*	130c
Learstar Mk. I (Lear)	314
Learstar Mk. II (Lear)	314
LEDUC ET FILS, RENÉ (France) ..	154
Leduc 0.10 (Breguet) .. *(1947)*	120c
LEGRAND-SIMON (France) ..	155
Leonides Herald (Handley Page) ..	83
Lerche (East Germany)	179
LETALSKI KONSTRUKCIJSKI BIRO (Yugoslavia) .. *(1954-55)*	300
Lévrier (S.N.C.A.C.) .. *(1947)*	116c
Libelle (East Germany)	180
Libellule (Sud-Ouest) .. *(1947)*	142c
Liftmaster DC.6A (Douglas) *(1951-52)*	230c
Light Aircraft (ML) .. *(1956-57)*	86
Lightning Swordfish (Lockheed) *(1947)*	255c
Lincoln (Avro) .. .. *(1951-52)*	25c
Little Dipper (Lockheed) .. *(1947)*	252c
Little Henry (McDonnell) .. *(1951-52)*	251c
Little Pink Cloud (Billman) ..	253
Loadmaster (Cancargo) .. *(1951-52)*	104c
LOCKHEED AIRCRAFT CORPORATION (U.S.A.)	315
Loisirs (Adam)	127
Lunak L.107 (Czechoslovakia) *(1952-53)*	104
Lurko (Hungary) .. *(1956-57)*	168
LUSCOMBE AIRPLANE CORPORATION (U.S.A.) .. *(1952-53)*	224

M

McCULLOCH MOTORS CORPN. AIRCRAFT DIVISION (U.S.A.) *(1954-55)*	268
McDONNELL AIRCRAFT CORPORATION (U.S.A.) .. *(1956-57)*	310
McKINNIE AIRCRAFT (U.S.A.) *(1955-56)*	287
McFARLAND AIRCRAFT CO. (U.S.A.) .. .. *(1952-53)*	262
M-1 (Sud-Ouest) .. *(1951-52)*	146c
M-1-D Sokol (Czechoslovakia) *(1953-54)*	120

Afterburners in NIMONIC alloys



Fairey FD.2 research aeroplane



Pressed ring in Nimonic 80 sheet for a Rolls-Royce afterburner.

Afterburners are a familiar feature of supersonic aircraft because of the great thrust increments they provide at high speeds. In the afterburners of British and British-licensed jet engines, extensive use is made of the Nimonic Series of High-Temperature Alloys, which are noted for their strength at elevated temperatures and their ability to resist oxidation, fatigue and thermal shock.

The continuous demand for improved performance has brought with it a steady increase of gas temperatures both in the engine and the reheat assembly. To meet the need for a material able to serve reliably in the more arduous conditions of the modern afterburner, Nimonic 80 has been introduced in sheet form for inner skins, fuel burners, flame holders and other parts in the vicinity of the combustion gas stream. In addition, Nimonic 75 and 80A are employed for support rings and certain other components.

OUR TECHNICAL SERVICE *is available to assist those with problems involving the choice of materials to resist corrosion or the effects of high temperatures.*

'Nimonic' is a Registered Trade Mark.

HENRY WIGGIN & COMPANY LIMITED *WIGGIN STREET · BIRMINGHAM 16*

TGA HTA11

PAGE

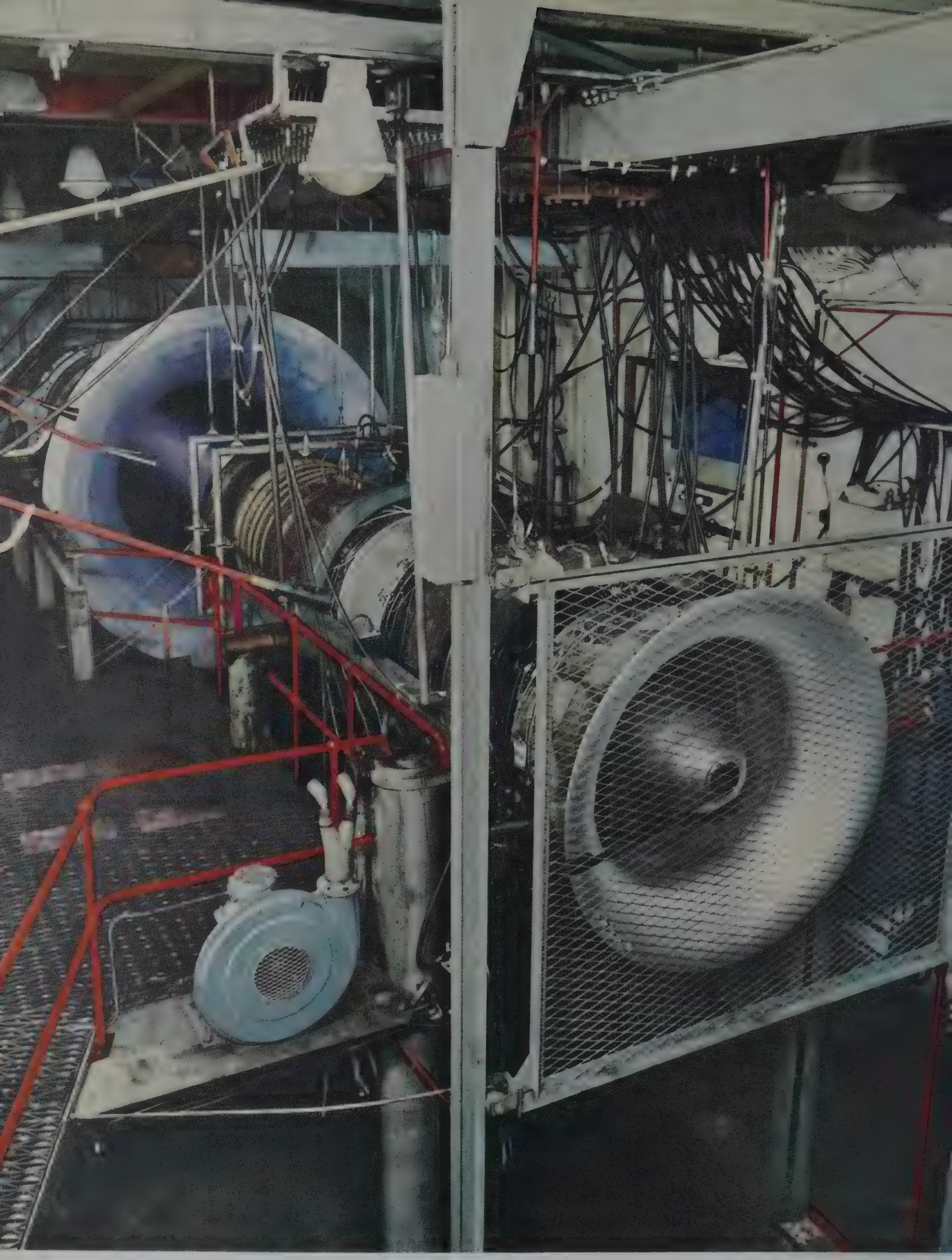
M.2 (Sud-Ouest) .. .. *(1951-52)* 143c
M.2 Skaut (Czechoslovakia) *(1951-52)* 109c
M-2 (Poland) 205
M-3 Pliszka (Poland) 205
M-4 (Poland) 205
M.3 Bonzo (Czechoslovakia) *(1950-51)* 112c
M-14 Helicopter (Marquardt) *(1951-52)* 262c
M-18 C55 (Mooney) .. *(1956-57)* 317
M-20 (Mooney) 336
M.25 (Miles) .. .. *(1947)* 67c
M.28 (Miles) .. .. *(1947)* 66c
M.33 (Miles) .. .. *(1947)* 65c
M.37 (Miles) .. .. *(1947)* 65c
M.38 (Miles) .. .. *(1948)* 31c
M.50 (Miles) .. .. *(1947)* 64c
M.57 (Miles) .. .. *(1948)* 81c
M.60 (Miles) .. .. *(1948)* 80c
M.65 (Miles) .. .. *(1948)* 79c
M.68 (Miles) .. .. *(1948)* 78c
M.71 (Miles) .. .. *(1948)* 78c
M.75 (Miles) .. .. *(1955-56)* 91
M.77 (Miles) .. .. *(1955-56)* 91
M.100 (Miles) 92
M.105 (Miles) .. .. *(1955-56)* 91
M.123 (Fouga) .. .. *(1947)* 122c
M.124 (Fouga) .. .. *(1947)* 123c
M.128 (Fouga) .. .. *(1947)* 123c
M-150 Schulmeister (Burgfalke) .. 172
M-185F (Fairchild) 294
M.200 (Fouga) .. .. *(1947)* 123c
M.300 (Fouga) .. .. *(1947)* 124c
MAC 125 (Meyers) .. *(1951-52)* 269c
M.B.5 (Martin Baker) .. *(1947)* 60c
M.B.70 (Brochet) 143
M.B.71 (Brochet) .. .. *(1956-57)* 131
M.B.72 (Brochet) .. .. *(1956-57)* 131
M.B.80 (Brochet) 143
M.B.80 A.B.C. (Dassault) *(1951-52)* 123c
M.B.100 (Brochet) 143
M.B.101 (Brochet) 143
M.B.110 (Brochet) 143
M.B.120 (Brochet) 144
M.B.300 (Marcel Bloch) .. *(1947)* 118c
M.B.307 (Macchi) .. *(1947)* 148c
M.B.308 (Macchi) .. *(1955-56)* 172
M.B.314 (Macchi) .. *(1948)* 170c
M.B.320 (Macchi) .. *(1956-57)* 176
M.B.323 (Macchi) .. *(1956-57)* 175
M.B.326 (Macchi) 186
M.B.500 (Marcel Bloch) .. *(1947)* 118c
MBR-2 (Russia) .. *(1947)* 161c
MAK-15MP (Kuzakov) 216
MC-4 (McCulloch) .. *(1954-55)* 268
MC-101 (Matra-Cantineau) *(1953-54)* 142
MD-12 (Poland) 205
M.D.80 ABC (Dassault) .. *(1951-52)* 123c
M.D.311 (Dassault) .. *(1954-55)* 137
M.D.312 (Dassault) .. *(1954-55)* 137
M.D.315 Flamant (Dassault) *(1954-55)* 137
M.D.316 (Dassault) .. *(1953-54)* 133
M.D.450 Ouragan (Dassault) .. 147
M.D.451 (Dassault) .. *(1952-53)* 115
M.D.452 Mystère (Dassault) .. 146
M.D.453 (Dassault) .. *(1953-54)* 133
M.D.550 (Dassault) .. *(1956-57)* 133
M.D.G. (see Instruments de Précision M.D.G.) .. .. *(1951-52)* 130c
MDR-6 (Russia) .. *(1947)* 161c
M.F.1 Passaro .. .. *(1949-50)* 149c
M.F.2 Bipassaro .. *(1949-50)* 149c
M.H.52 (Max Holste) .. *(1951-52)* 131c
M.H.53 (Max Holste) .. *(1951-52)* 131c
M.H.250 Super Broussard (Max Holste) 156
M.H.1521 Broussard (Max Holste) .. 156
MIE Sokol .. .. *(1951-52)* 111c
M.H.152 (Max Holste) .. *(1952-53)* 122
MI-1 (Mil) 218
MI-1U (Mil) 219
MI-3 (Mil) 219
MI-4 (Mil) 219
MIG (Russia) 216
MIG-3 .. .. *(1947)* 158c
MIG-9 .. .. *(1951-52)* 174c
MIG-15 217
MIG-15*bis* 218
MIG-15UTI 218
MIG-17 216
MIG-19 216
MIG-21 200
MIS-1 (Poland) .. .. *(1950-51)* 165c
M.J.2 Tempête (Jurca) 154
M.K.E.K. (Turkey) 239
ML-10 (Millet-Lagarde) .. *(1951-52)* 131c
MP. 214 (Plan) .. .. *(1956-57)* 145
MR-2 (Rumania) 208
MS-7C Avitruc (Chase) .. *(1951-52)* 214c
MS-8 Avitruc (Chase) .. *(1953-54)* 213
M.S. 472 (Morane-Saulnier) *(1947)* 125c
M.S. 473 (Morane-Saulnier) *(1947)* 126c
M.S. 474 (Morane-Saulnier) *(1951-52)* 132c
M.S. 475 (Morane-Saulnier) *(1947)* 126c
M.S. 475 (Morane-Saulnier) *(1951-52)* 132c
M.S. 477 (Morane-Saulnier) *(1952-53)* 122
M.S. 479 (Morane-Saulnier) *(1952-53)* 123

PAGE

M.S. 502 (Morane-Saulnier) *(1947)* 126c
M.S. 560 (Morane-Saulnier) *(1947)* 127c
M.S. 570 (Morane-Saulnier) *(1947)* 128c
M.S. 571 (Morane-Saulnier) *(1948)* 146c
M.S. 660 (Morane-Saulnier) *(1947)* 128c
M.S. 700 (Morane-Saulnier) *(1952-53)* 123
M.S. 701 (Morane-Saulnier) *(1952-53)* 123
M.S. 703 (Morane-Saulnier) *(1952-53)* 123
M.S. 704 (Morane-Saulnier) *(1952-53)* 123
M.S. 708 (Morane-Saulnier) *(1952-53)* 123
M.S. 730 (Morane-Saulnier) *(1953-54)* 143
M.S. 731 (Morane-Saulnier) *(1953-54)* 144
M.S. 732 (Morane-Saulnier) *(1953-54)* 144
M.S. 733 (Morane-Saulnier) *(1956-57)* 146
M.S. 735 (Morane-Saulnier) *(1956-57)* 146
M.S. 755 (Morane-Saulnier) *(1956-57)* 145
M.S. 760 Paris (Morane-Saulnier) .. 157
M.S. 1500 Epervier (Morane-Saulnier) 156
MV-1 Starflight (Monsted-Vincent) *(1949-50)* 256c
MX-324 (Northrop) .. *(1947)* 274c
M.L. AVIATION CO., LTD. (G.B.) .. 91
Mach-Trainer (Fokker) 199
MACCHI S.A., AERONAUTICA (Italy) 186
McCULLOCH MOTORS CORPORATION (U.S.A.) .. *(1954-55)* 268
McDONNELL AIRCRAFT CORPORATION (U.S.A.) 328
McKINNIE AIRCRAFT COMPANY (U.S.A.) 331
Madge (Beriev) 212
MAESTRANZA CENTRAL DE AVIACION (Cjile) .. *(1956-57)* 120
Magister (Fouga).. 150
Magister Marine (Fouga) 151
Magnet (Yakovlev) .. *(1955-56)* 194
Makalu (Fouga) 151
MAKINAVE KIMYA ENDUSTRISI KURUMU (Turkey) 239
Mallard G.73 (Grumman) .. *(1951-52)* 246c
Mantis (Gail) 298
Manx (Handley Page) .. *(1947)* 52c
Marathon 1 (Handley Page) *(1955-56)* 84
Marathon 2 (Handley Page) *(1952-53)* 69
Mariner (Martin) .. *(1950-51)* 259c
Marksman (On Mark) 346
Marlin (Martin) 334
MARQUARDT AIRCRAFT COMPANY (U.S.A.) .. *(1951-52)* 262c
Marreco (I.P.T.) .. *(1951-52)* 14c
Mars (Breguet) .. .. *(1951-52)* 119c
Mars JRM-1 (Martin) .. *(1951-52)* 267c
Mars JRM-2 (Martin) .. *(1951-52)* 267c
MARTIN COMPANY, THE (U.S.A.) 331
MARTIN (see Glenn L. Martin Co.) .. 313
MARTIN-BAKER AIRCRAFT CO., LTD. (G.B.) .. .. *(1954-55)* 87
Martinet M-25 (Miles) .. *(1947)* 67c
Martinet N.C. 702 (S.N.C.A.C.) *(1949-50)* 112c
Mascot (Ilyushin) 214
Matador (Martin) 335
Matajur (Yugoslavia) 376
Matajur-Trised (Yugoslavia) .. 376
MATRA-CANTINIEAU (France) *(1953-54)* 142
Mauler AM-1 (Martin) .. *(1951-52)* 266c
Max (Yakovlev) 223
MAX HOLSTE (France) 156
MAX PLAN (France) 156
Maya (Philippine) .. *(1956-57)* 192
Mentor (Beechcraft) 245
Mentor (Fuji) .. .. *(1956-57)* 182
Mercator P4M-1 (Martin) .. *(1951-52)* 263c
Merchantman (Miles) .. *(1948)* 78c
Mercure (Breguet) .. *(1951-52)* 118c
Mercurey (Boisavia) 138
Merganser (Percival) .. *(1948)* 84c
Messenger (Miles) .. *(1948)* 81c
MESSERSCHMITT A.G. (Germany) 175
Meta-Sokol (Czechoslovakia) .. 130
Meteor (Armstrong Whitworth) *(1956-57)* 44
Meteor (Gloster) .. .. *(1956-57)* 76
Meteor (Monocoupe) .. *(1956-57)* 317
METEOR s.p.a. COSTRUZIONI AERONAUTICHE (Italy) .. 187
Meteor Trainer (Gloster) .. *(1951-52)* 58c
Metropolitan (Convair) 277
MEYERS AIRCRAFT COMPANY (U.S.A.) .. .. *(1951-52)* 269c
Meyers MAC 125-C .. *(1947)* 265c
Midge (Folland) .. .. *(1955-56)* 77
Midget (MIG) 218
Midget Mustang (Schweizer) *(1949-50)* 274c
Midgy Club (M.D.G.) .. *(1951-52)* 130c
Midjet (Fouga) .. .. *(1953-54)* 135
MIG (Russia) 216
MIGNET (see AVIOES MIGNET DO BRASIL) .. .. *(1953-54)* 43
MIL, MIKHAIL L (Russia) .. 218
MIKOYAM & GUREVICH (MIG) (Russia) .. .. .. *(1955-56)* 191
MILES, F. G., LTD. (G.B.) .. 92
Military Consul (Airspeed) .. *(1950-51)* 17c

PAGE

MILLETT LAGARDE SOCIETE (France) .. .. *(1951-52)* 131c
Milutinovic (Yugoslavia) .. *(1952-53)* 247
Minicab (C.A.B.) .. *(1956-57)* 132
MINIÉ AERONAUTIQUE, ETABLISSEMENTS VICTOR (France) *(1953-54)* 142
Minijet (SIPA) .. .. *(1956-57)* 158
Mirage (Dassault) 144
Mis 1 (Poland) .. .. *(1951-52)* 168c
Mistrel (Sud-Est) .. *(1953-54)* 152c
Mitchell (North American) .. *(1950-51)* 268
Mite (Mooney) .. .. *(1956-57)* 317
MITSUBISHI JUKOGYO K.K. (Japan) 195
Model One (Aerocar) 242
Model 2 (Transcendental) 369
Model 7EC (Champion) 267
Model 7FC (Champion) 267
Model 8F (Silvaire) 362
Model 14-19-2 (Northern) .. 343
Model 15-AT (Hayden) 306
Model 20 (Taylorcraft) 366
Model 20AG (Taylorcraft) 366
Model 44 (Vertol) 371
Model 45 Mentor (Beechcraft) .. 245
Model 47 (Agusta-Bell) 183
Model 47G (Bell) 250
Model 47H (Bell) 251
Model 47J (Bell) 251
Model 51 (Temco) 367
Model 61 (Bell) 252
Model 73 Jet Mentor (Beechcraft) .. 246
Model 75 (Potez) 163
Model 76 (Vertol) 372
Model 82 (McDonnell) 331
Model 86 (McDonnell) 331
Model 95 Travel Air (Beechcraft) .. 244
Model 120 (Fawcett) 117
Model 159 Gulfstream (Grumman) .. 299
Model 165 (McKinnie) 331
Model 172 (Cessna) 265
Model 180 (Cessna) 266
Model 182 (Cessna) 266
Model 188A (Electra Lockheed) .. 317
Model 200 (Bell) 249
Model 202 Mantis (Gail) 298
Model 212 (Bell) 249
Model 237 (Martin) 334
Model 269 (Hughes) 310
Model 272 (Martin) 332
Model 275 (Martin) 332
Model 310 (Cessna) 265
Model 318 (Cessna) 263
Model 321 (Cessna) 265
Model 440 Metropolitan (Convair) .. 277
Model 450 Marksman (On Mark) .. 344
Model 620 (Cessna) 263
Model 674 Valiant (Vickers) .. 104
Model 680 Super (Aero) 241
Model 707 Stratoliner (Boeing) .. 254
Model 717 (Boeing) 257
Model 880 (Convair) 276
Model 1049 Super Constellation (Lockheed) 319
Model 1649A Starliner (Lockheed) .. 322
Model S (Auster) .. .. *(1953-54)* 46
Mohawk (Grumman) 300
Mojave (Sikorsky) 360
MOLYNEUX HELICOPTER CO., PTY., LTD. (Australia) .. 117
Monitor (Miles) .. .. *(1947)* 65c
Monitor (Farman) 149
Monitor (NEIVA) 47
Monitor IV (Stampe-Renard) 45
MONOCOUPE AIRCRAFT OF FLORIDA, INC. (U.S.A.) *(1956-57)* 317
MOONEY AIRCRAFT INC. (U.S.A.) .. 336
Moose (Yakovlev) 224
MORANE-SAULNIER, AÉROPLANES (France) 156
MORIN, PIERRE (France) *(1953-54)* 144
Moskva (Ilyushin) 214
Mosquito (D.H.) .. *(1949-50)* 49c
MOTOKOV LTD. (Czechoslovakia) *(1955-56)* 125
Motor-Möwe (Dittmar) .. *(1956-57)* 163
Motor Tutor (Slingsby) .. *(1952-53)* 80
MÖWE-FLUGZEUGBAU HEINI DITTMAR (Germany) 173
Mraz (Czechoslovakia) .. *(1949-50)* 104c
Mucha 100 (Poland) 206
Multoplane (RWF) 175
MUNIZ, Cassio, S.A. (Brazil) (see OMAREAL) .. .. *(1956-57)* 43
Musang (Philippines) 202
Musca 1 (Muscariello) .. *(1953-54)* 163
MUSCARIELLO Ing. F. (Italy) *(1953-54)* 163
MV-1 Starflight (Monsted-Vincent) *(1949-50)* 256c
Mystère II (Dassault) 146
Mystère IV A (Dassault) 146
Mystère IV B (Dassault) 146
Mystere IV N (Dassault) .. *(1956-57)* 135



25,000 pounds of thrust

A Gyron supersonic turbojet during a test run with reheat

DE HAVILLAND ENGINES

GYRON GYRON JUNIOR SPECTRE

PAGE

N

N|76 (Hawker) .. .. *(1949-50)* 63c
N-9M (Northrop).. .. *(1947)* 273c
N.20 (Federale) .. *(1952-53)* 167
N.52 (Okamura) .. .. *(1956-57)* 134
N.113 (Supermarine) 102
NA.39 (Blackburn) 58
N.A.63 (North American) .. *(1947)* 172c
NA-75 (National) 337
N.A.130 (North American) *(1947)* 268c
N.A.140 (North American) .. *(1947)* 268c
N.A.141 (North American) Fury *(1948)* 300c
N.A.142 (North American) .. *(1949-50)* 262c
N.A.145 Navion (North American) *(1947)* 267c
N.A.147 (North American) .. *(1948)* 301c
N.A.159 (North American) .. *(1952-53)* 233
N.A.160 (North American) .. *(1949-50)* 260c
NAA-249 (North American) .. 342
N.C.211 Cormoran (S.N.A.C.) *(1949-50)* 110c
N.C.270 (S.N.C.A.C.) .. *(1949 50)* 110c
N.C.271 (S.N.C.A.C.) .. *(1949-50)* 110c
N.C.702 Martinet (S.N.C.A.C.) *(1949-50)* 112c
N.C.800 (S.N.C.A.C.) .. *(1947)* 114c
N.C.810 (S.N.C.A.C.) .. *(1947)* 114c
N.C.820 (S.N.C.A.C.) .. *(1947)* 115c
N.C.830 (S.N.C.A.C.) .. *(1947)* 115c
N.C.840 (S.N.C.A.C) .. *(1947)* 115c
N.C.850 Club .. .. *(1948)* 134c
N.C.854 (S.N.C.A.C.) .. *(1949-50)* 112c
N.C.856 (Nord) .. *(1956-57)* 149, 150
N.C.860 (S.N.C.A.C.) .. *(1949-50)* 113c
N.C.1071 (S.N.C.A.C.) .. *(1949-50)* 111c
N.C.1072 (S.N.C.A.C.) .. *(1949-50)* 111c
N.C.1080 (Nord) .. .. *(1950-51)* 134c
N.C.2001 Abeille (S.N.C.A.C.) *(1949-50)* 113c
N.C.2002 (S.N.C.A.C.) .. *(1949-50)* 113c
N.C.3020 Belphegor (N.S.C.A.C.) *(1949-50)* 113c
N.F.11 (Armstrong Whitworth (1952-53) 34
NH1 (see Nederlandse Helicopter Industrie N.V.) 201
NH-160 (Nagler) 336
NIK2-J George (Kawanishi) (1945-46) 160c
N.1M (Northrop) .. *(1947)* 272c
NRK (Antonov) 211
NU-200 (Indonesia) .. *(1956-57)* 169
NU-225 Sikumbang (Indonesia) .. 181
Nu.D.36 (Nuri Demirag) .. *(1949-50)* 183c
NAGLER HELICOPTER COMPANY INC. (U.S.A.) 336
Nancu (Instituto Aerotecnico) (1951-52) 7c
NARDI S.A. PER COSTRUZIONI AERONAUTICHE (Italy) .. 188
Narvel (Sud-Ouest) .. *(1949-50)* 137c
NATIONAL AIRCRAFT CORP. (U.S.A.) 337
Navion (Ryan) .. *(1952-53)* 242
NEDERLANDSE HELICOPTER IND. N.V. 201
NEIVA (see SOC. CONSTRUTORA AERONAUTICA NEIVA, LTDA (Brazil) 46
Nelson Dragonfly Sailplane *(1947)* 266c
Nene-Lancastrian (Avro) .. *(1947)* 19c
Nene-Viking (Vickers) .. *(1950-51)* 94c
Neptune (Lockheed) 324
Newbury Eon (Elliotts) .. *(1950-51)* 54
Nibbio (Aviamilano) 184
Nietoperz (Poland) .. *(1953-54)* 174
Nifty (Morrisey) .. *(1950-51)* 261c
Nikko (Fuji) 194
Nimbus (Short) .. .. *(1948)* 97c
Noralpha (Nord) .. .. *(1948)* 147c
Noratlas (Nord) 159
Norazur (Nord) .. .. *(1949-50)* 127c
NORD (see Société Nationale de Constructions Aeronautiques du Nord) .. 157
Nord 1101 .. .. *(1948)* 147c
Nord 1201 .. .. *(1948)* 148c
Nord 1203|II Norécrin II .. *(1951-52)* 134c
Nord 1221 Norelana .. *(1949-50)* 125c
Nord 1226 .. .. *(1956-57)* 149
Nord 1300 .. .. *(1948)* 151c
Nord 1400 .. .. *(1951-52)* 135c
Nord 1402 158
Nord 1405 159
Nord 1500 Noréclair .. *(1949-50)* 126c
Nord 1500 Griffon 158
Nord 1600 .. .. *(1948)* 149c
Nord 1601 .. .. *(1951-52)* 136c
Nord 1700 .. .. *(1948)* 149c
Nord 1750 Norelfe .. *(1955-56)* 154
Nord 2000 .. .. *(1948)* 150c
Nord 2100 Norazur .. *(1949-50)* 127c
Nord 2200 .. .. *(1951-52)* 137c
Nord 2500 .. .. *(1951-52)* 137c
Nord 2501 159
Nord 3200 .. .. *(1956-57)* 148
Nord 3201 .. .. *(1956-57)* 148
Nord 3202 159
Noréclair (Nord) .. *(1949-50)* 126c
Norécrin (Nord) .. .. *(1951-52)* 134c
Norelan (Nord) .. .. *(1949-50)* 125c
Norelfe (Nord) .. .. *(1955-56)* 154
NORMANDE, SOCIETE AERONAUTIQUE (France) 162
Noroit (Nord) .. .. *(1954-55)* 148
Norseman (C.C.F.) .. *(1950-51)* 101c
NORSK FLYINDUSTRI A|S (Norway) .. .. *(1955-56)* 184
NORTH AMERICAN AVIATION, INC. (U.S.A.) 337
NORTHERN AIRCRAFT INC. (U.S.A.) 343
NORTHROP AIRCRAFT, INC. (U.S.A.) 344
Norvigie (Nord) .. .. *(1956-57)* 149
NURI DEMIRAG TAYYARE FABRIKASI (Turkey) .. *(1952-53)* 168

O

O.1 (Morin) .. .. *(1953-54)* 144
O.10 (Leduc) .. .. *(1955-56)* 146
O.21 (Leduc) 154
O.22 (Leduc) 155
O.101 (Arsenal) .. .. *(1949-50)* 114c
OE-1 (Cessna) 264
OE-2 (Cessna) 265
OF-1 (Grumman) 300
OFW (see OSTERREICHISCHE FLUGZEUGWERK) 44
OK-15 (OFW) 44
OKA 32 (Antonov) .. *(1951-52)* 170c
OQ-1A (Fletcher) .. *(1947)* 233c
OQ-19 (Radioplane) 350
OTW-160 (Meyers) .. *(1949-50)* 255c
Observer (Luscombe) .. *(1949-50)* 244c
OFICINA DE MANUTENÇÃO E RECUPERAÇÃO DE AVIOES, LTDA (Brazil) 47
OFICINAS GERAIS DE MATERIAL AERONAUTICO (Portugal) .. 208
OKAMURA SEISAKUJO K.K. (Japan) .. .. *(1956-57)* 184
Olympia Eon (Elliotts) .. *(1950-51)* 54c
OMAREAL (Brazil) (see OFICINA DE MANUTENÇÃO E RECUPERAÇÃO DE AVIOES, LTDA) 47
Omega Development (Bratukhin) *(1951-52)* 170c
OMEGA AIRCRAFT CORPORATION (U.S.A.) 345
ON MARK ENGINEERING CO. (U.S.A.) 346
Orao (Yugoslavia) .. *(1952-53)* 248
Orel (Czechoslovakia) .. *(1947)* 105c
OSTERREICHISCHE FLUGZEUGWERK G.m.b.H. (Austria) .. 44
Otter DHC-3 (D.H. Canada) .. 123
Ouragan (Dassault) 147
OUEST-AVIATION, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AERONAUTIQUES (France) *(1956-57)* 152
Oxford (Airspeed) .. *(1947)* 10c

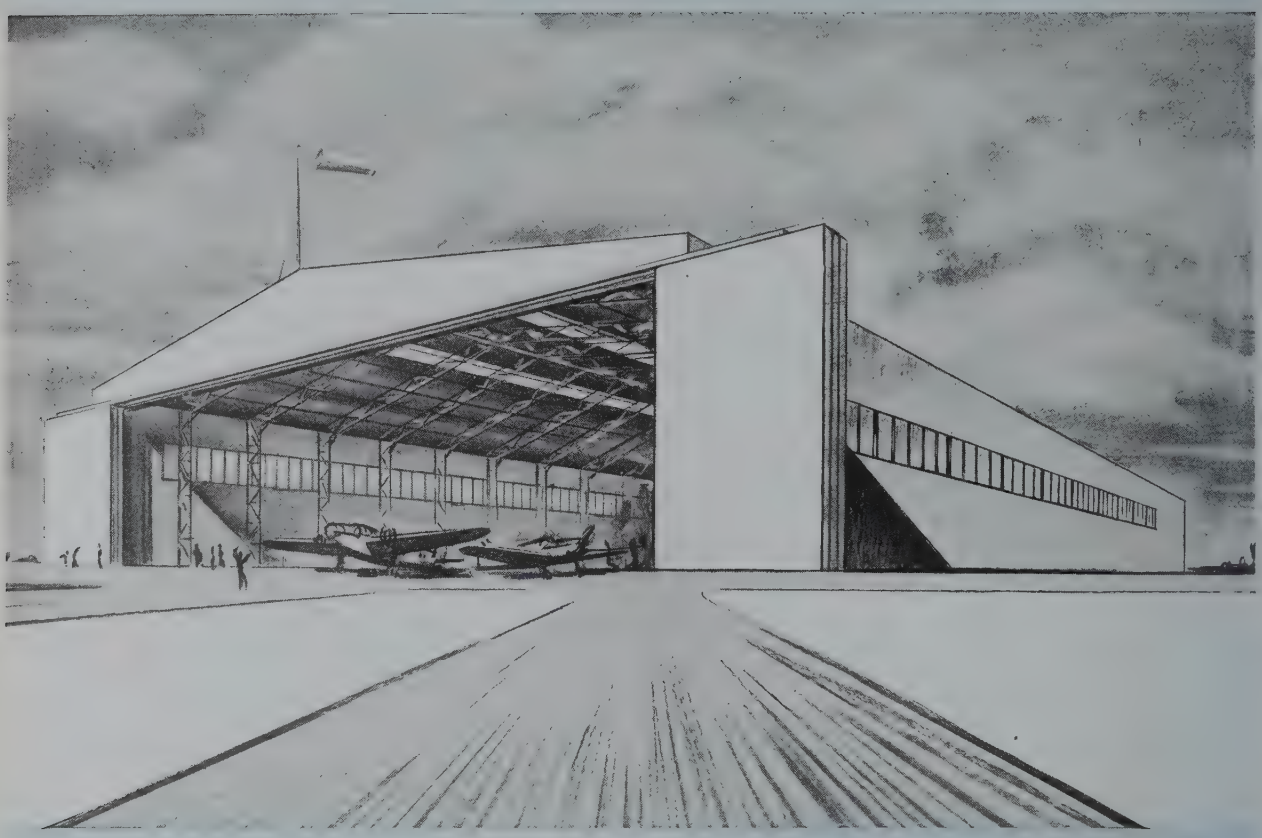
P

P-1 (English Electric) 72
P.1 Partner (Fokker) .. *(1947)* 154c
P.2 (Pilatus) .. .. *(1951-52)* 190c
P2B-1 (Boeing) .. *(1951-52)* 208c
P2V Neptune (Lockheed) .. 325
P-3 (Pilatus) 238
P.4 (Pilatus) .. .. *(1951-52)* 190c
P4M-1 Mercator (Martin) .. *(1951-52)* 263c
P5M Marlin (Martin) 334
P6M Sea Master (Martin) 332
P-16 (FFA) .. .. *(1956-57)* 222
P-16C (Northrop) .. *(1947)* 277c
P.18 (Ambrosini) 183
P-33M (Lockheed) .. *(1947)* 254c
P.40 Prentice (Percival) .. *(1951-52)* 70c
P.44 Proctor 5 (Percival) .. *(1949-50)* 70c
P.47 Proctor 6 (Percival) .. *(1949 50)* 71c
P.50 Prince III (Hunting Percival) *(1955-56)* 88
P.51H (North American) Mustang Fighter .. *(1947)* 270c
P-53 Aeroscooter (Partenavia) .. 189
P.54 Survey Prince IIIA (Hunting Percival) .. .. *(1955-56)* 89
P-55 Tornado (Partenavia) .. 190
P.56 Provost (Hunting Percival) .. 88
P-57 Fachiro (Partenavia) 189
P.57 Sea Prince (Hunting Percival) *(1956-57)* 85
P.61B (Northrop) Black Widow Night Fighter .. .. *(1947)* 277c
P.66 Pembroke (Hunting Percival) .. 89
P.74 (Hunting Percival) .. *(1955-56)* 86
P.80A (Lockheed) Shooting Star (1947) 248c
P.82 (North American) Twin Mustang Fighter Bomber .. *(1947)* 269c
P.82B (North American) Twin Mustang *(1947)* 268c
P.84 Jet Provost (Hunting Percival) *(1956-57)* 83
P.84 Thunderjet (Republic) Night Fighter .. .. *(1947)* 284c
P.85 Jet Provost (Hunting Percival) .. 87
P.92 (Boulton Paul) .. *(1947)* 25c
P.108 Balliol (Boulton Paul) (1955-56) 57
P.110 (C.V.V.) .. .. *(1951-52)* 154c
P.111 (Boulton Paul) .. *(1955-56)* 58
P.120 (Boulton Paul) .. *(1953-54)* 54
P.136 (Piaggio) 191
P.148 (Piaggio) 191
P.149 (Piaggio) .. .. *(1956-57)* 179
P.149-D (Piaggio) 191
P.150 (Piaggio) .. .. *(1956-57)* 179
P-155 (Piaggio) 191
P-166 (Piaggio) 191
P-177 (Saunders-Roe) 96
P.512 (Ambrosini) .. *(1950-51)* 148c
P.1040 (Hawker) .. *(1949-50)* 63c
P.1052 (Hawker) .. *(1953-54)* 82
P.1072 (Hawker) .. *(1952-53)* 70
P.1081 (Hawker) .. *(1951-52)* 64c
P.1121 (Hawker) 85
P-1604 (FFA) 238
PA-6 (Piper) Skysedan .. *(1947)* 278c
PA-11 Trainer (Piper) .. *(1949-50)* 268c
PA-12 (Piper) .. .. *(1948)* 310c
PA-14 Family Cruiser (Piper) *(1949-50)* 268c
PA-15 (Piper) .. .. *(1949 50)* 268c
PA-16 Clipper (Piper) .. *(1949-50)* 269c
PA-17 Vagabond (Piper) .. *(1949-50)* 269c
PA-18 Super Cub (Piper) .. 348
PA-18-A (Piper) 349
PA-19 Super Cub (Piper) .. *(1951-52)* 282c
PA-20 Pacer (Piper) .. *(1954-55)* 286
PA-22 Tri-Pacer (Piper) 348
PA-23 (Piper) 348
PA-42 Comanche (Piper) 347
PA.49/B (Payen).. 162
PA-204 Super Cigale (Aubert) .. 138
PA-300 (Aubert) .. .. *(1954-55)* 129
PB4Y-2 (Consolidated Vultee) (1947) 204c
PB4Y-2M Privateer .. *(1947)* 204c
PBM Mariner (Martin) .. *(1950-51)* 259c
P.D.3 (Piaggio) .. .. *(1947)* 149c
P.D.11 (Short) .. .. *(1956-57)* 90
PD-18 (Piasecki) .. *(1955-56)* 301
PD-22 (Piasecki) .. *(1955-56)* 302
PE-2 (Petlyakov) .. *(1951-52)* 174c
PE-3 (Petlyakov) .. *(1947)* 160c
PE-8 (Petlyakov) .. *(1949-50)* 166c
PF.204 (Max Plan) .. *(1955-56)* 148
PL.5C (Aerauto) .. .. *(1952-53)* 136
PL-7 (Kingsford Smith) 117
P.M.280 Tartuca (C.V.V.) .. *(1951-52)* 154c
PO-1W Constellation (Lockheed) *(1951-52)* 252c
PO-2 (Polikarpov) .. *(1953-54)* 179
PQ-8A (TDC-2) Culver .. *(1947)* 208c
PQ-14 (TD2C-1) Culver .. *(1947)* 209c
PO-2W Constellation (Lockheed) *(1951-52)* 252c
PS-84 (Russian DC-3) .. *(1948)* 195c
PT-1 (Piper) .. .. *(1947)* 279c
PTV-N-2 (Martin) .. *(1949-50)* 254c
PV-3 Rescuer (Piasecki) .. *(1955-56)* 302
PV-14 Retriever (Piasecki) .. *(1951-52)* 280c
PV-15 Transporter (Piasecki) (1955-56) 302
PV-17 (Piasecki) .. *(1955-56)* 302
P.Z.L. S.1 (Poland) .. *(1951-52)* 168c
Pacer (Piper) .. .. *(1954-55)* 286
Pack Plane (Fairchild) .. *(1951-52)* 236c
Packet (Fairchild) .. 294
Pajtás (Hungary) .. *(1956-57)* 168
Panther (Grumman) .. *(1955-56)* 263
Pantobase (Stroukoff) 365
Parasite (McDonnell) .. *(1948)* 286c
Paris (Morane-Saulnier) 157
Paris-Nice (Wassmer) 171
Parrakeet (Hannaford) .. *(1949-50)* 223c
PARTENAVIA CONSTRUZIONI AERONAUTICHE (Italy) .. 189
Partner (Fokker) .. .. *(1947)* 154c
PASOTTI s.p.a., LEGNAMI (Italy) .. 190
Passaro (Movo) .. .. *(1949-50)* 149c
Paulistinha-56 (Neiva) 46
Paulistinha (Companhia Aeronautica Paulista) .. .. *(1948)* 13c
Pawnee (Hiller) 309
PAYEN AVIATION (France) .. 162
Pchelka (Antonov) 212
Pedro (G.C.A.) .. .. *(1951-52)* 157c
Pégase (Sud-Ouest) .. *(1950-51)* 144c
Pegaz (Poland) .. .. *(1951-52)* 168c

GENERAL UTILITY

STEEL BUILDINGS

AND HANGARS

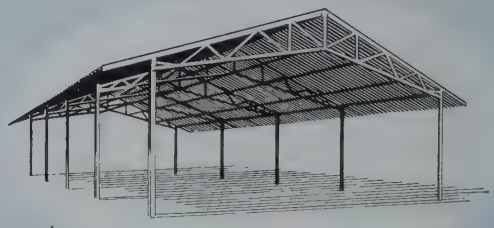


STANDARD DESIGNS 200′ 0″ TO 30′ 0″ SPANS

STEEL ECONOMY · SPACE ECONOMY

TROPICAL SHEDS & HOUSES · GODOWNS · BARRACKS · OFFICES ETC.





We supply and erect
in any part of the world

BELLMAN HANGARS

LIMITED

HOBART HOUSE, LONDON, S.W.1. TEL: SLOANE 5259 · CABLES: UNITSTRUCT, SOWEST

		PAGE
Pelican (Doman)	*(1951-52)*	223c
Pembroke (Hunting Percival)		89
Peque (AISA)	*(1955-56)*	198
PERCIVAL AIRCRAFT LTD. (G.B.) (see Hunting Percival)	*(1954-55)*	83
PERCIVAL, EDGAR AIRCRAFT LTD. (G.B.)	*(1956-57)*	66
PETLYAKOV, VLADIMIR (Russia)	*(1952-53)*	155
PETROLINI HERMANOS. SOC. ANON IND. Y COM. (Argentine Republic)	*(1951-52)*	10c
Phantom (Fokker)	*(1947)*	154c
Phantom (McDonnell)	*(1950-51)*	252c
Phrygane (C.F.A.)	*(1953-54)*	131
Phryganet (C.F.A.)	*(1951-52)*	122c
PIAGGIO & C. SOCIETA PER AZIONI (Italy)		191
PIASECKI HELICOPTER CORPORATION (U.S.A.) (see VERTOL AIRCRAFT CORP.)	*(1955-56)*	300
PIASECKI AIRCRAFT CORP. (U.S.A.)		347
PIEL AVIATION (France)		162
PIK (see Polyteknikkojen Ilmailukerho) (Finland)		135
PIK-11		135
PIK-12		136
PIK-13	*(1955 56)*	129
Pika (Australia)	*(1956-57)*	106
PILATUS FLUGZEUGWERKE A.G. (Switzerland)		228
Pinto (Temco)		367
Pinty (Aero-Ever)	*(1951-52)*	149c
Pinwheel (Rotor-Craft)		355
Pioneer (Northrop)	*(1948)*	307c
Pioneer (Scottish Aviation)		97
Pionir (Yugoslavia)	*(1955-56)*	321
PIPER AIRCRAFT CORPORATION (U.S.A.)		347
Piper Skycoupe	*(1947)*	278c
Piper Skycycle	*(1947)*	279c
Piper-Stinson (Piper)	*(1949-50)*	269c
Pirate F6U-1 (Chance Vought)	*(1950-51)*	213c
PLAN, MAX (France)	*(1955-56)*	148
PLANADORES NEIVA (Brazil)	*(1953-54)*	43
Planalto (I.P.T.)	*(1951-52)*	12c
Playboy (Stits)		363
Plebe (Temco)	*(1954-55)*	296
Pjiszka (Poland)		205
Plover (Martin)	*(1952-53)*	229
Polar (Wideroe)	*(1952-53)*	147
POLIKARPOV, NIKOLAI N. (Russia)	*(1953-54)*	179
POLYTEKNIKKOJEN ILMAILUKERHO (Finland)		135
Portsmouth Aerocar	*(1948)*	86c
Potez 75 (Potez)	*(1955-56)*	156
POTEZ ETABLISSEMENTS HENRI (France)		163
Praga (Czechoslovakia)	*(1948)*	126c
Praga E-55 (Czechoslovakia)	*(1956-57)*	121
Prefect (Slingsby)		101
Prentice (Percival)	*(1951-52)*	70c
President (Hunting Percival)		90
Prestwick Pioneer (Scottish Aviation)		98
Prestwick Twin Pioneer (Scottish Aviation)		98
Primary Eon (Elliotts)	*(1950-51)*	55c
Primer (Fairey)	*(1950-51)*	59c
Prince III (Hunting Percival)	*(1955-56)*	88
Princess (Saunders-Roe)	*(1955-56)*	92
Proctor 5 (Percival)	*(1949-50)*	70c
Proctor 6 (Percival)	*(1949-50)*	71c
Promotor (Fokker)	*(1949-50)*	154c
Prone Pilot Meteor 8		45
Prospector (Cub Aircraft)	*(1949-50)*	99c
Provence (Breguet)	*(1951-52)*	119c
Provider (Fairchild)		296
Provost (Hunting Percival)		88
Puget Pacific Wheelair IIIA	*(1947)*	281c
Pulqui I (Instituto Aerotecnico)	*(1951-52)*	8c
Pulqui II (I. A.)	*(1956-57)*	40

Q

Q-2 Firebee (Ryan)		356
QR.14 (Marinavia)	*(1948)*	170c
Queen Martinet (Miles)	*(1947)*	64c

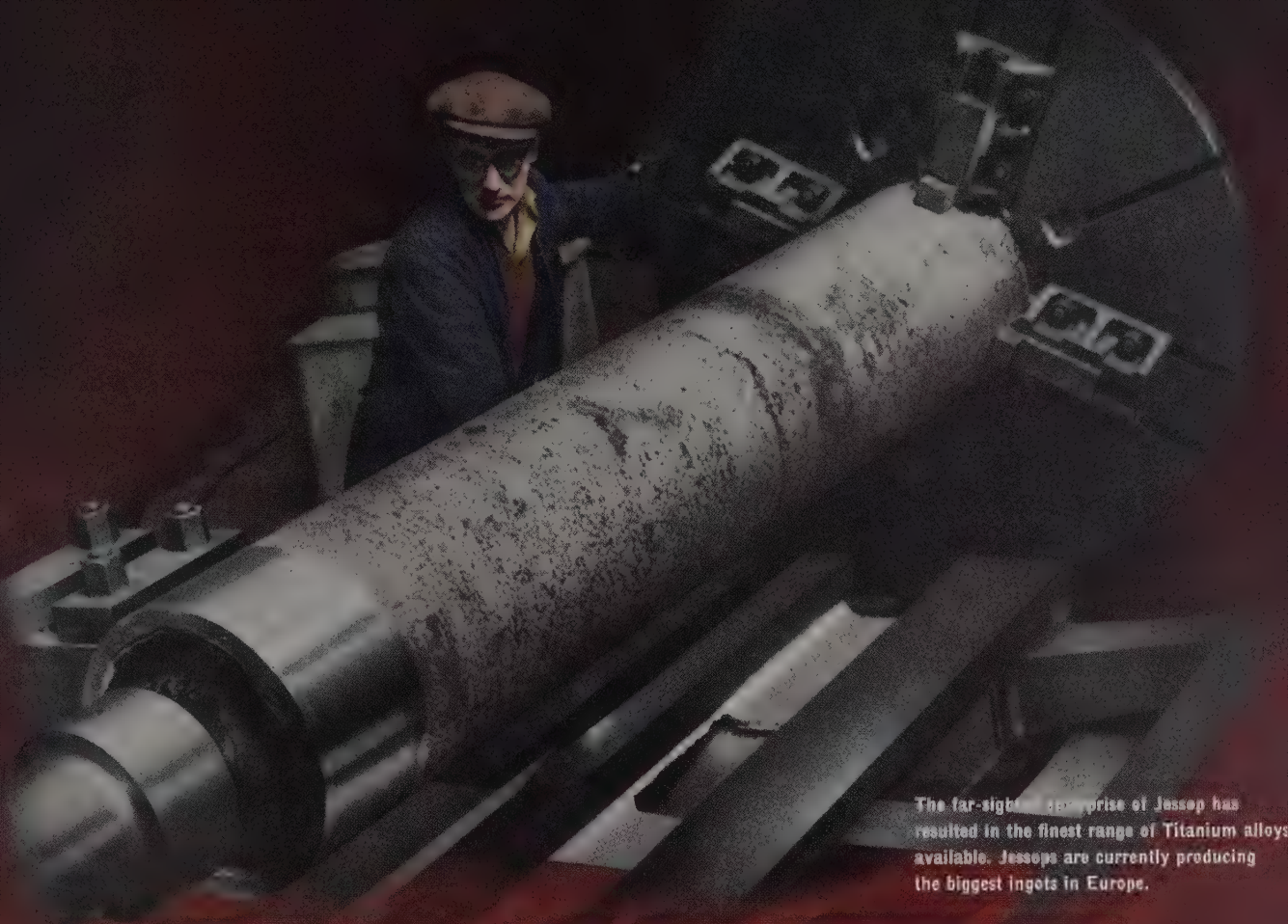
R

R.1 (Rey)	*(1952-53)*	126
R3Y Tradewind (Convair)		273
R4D (Douglas)	*(1952-53)*	205
R4D 8 (Douglas)	*(1951-52)*	232c
R4Q Packet (Fairchild)		294
R4Y (Convair)		280
R5D (Douglas)		277
R6D-1 (Douglas)		293
R.7V (Lockheed)		319
R.10 Kanya (Aero-Ever)	*(1951-52)*	149c
R.14 Pinty (Aero-Ever)	*(1951-52)*	149c
R-15A (Northrop)	*(1948)*	308c
R.18 (Hungary)	*(1956-57)*	168
R-52 Tachikawa)	*(1953-54)*	168
R-53 Shin (Tachikawa)		195
R.60-1 Constitution (Lockheed)	*(1950-51)*	245c
R.70-1 Constellation (Lockheed)	*(1951-52)*	252c
R.A.14 Loisirs (Adam)	*(1956-57)*	127
R.A.17 (Adam)	*(1951-52)*	116c
RB-66 (Douglas)		287
RC-2 Rainbow (Republic)	*(1947)*	283c
RC-3 Seabee Amphibian	*(1947)*	282c
RC-121 (Lockheed)		319
RC-131 (Convair)		280
RF-84F (Republic)		354
RF-84K (Republic)		332
EF-84K (Republic)	*(1956-57)*	332
RF-101 (McDonnell)		329
RG-6 (Rumania)		209
RG-60 (S.E.C.A.T.)	*(1948)*	153c
RG-75 (S.E.C.A.T.)	*(1948)*	153c
RH-1 (Rotor-Craft)		355
RL-26D (Aero)		241
R-HM Shin (Tachikawa)		195
RM-1 (Martin)	*(1953-54)*	255
RP-63G (Bell)	*(1947)*	154c
RP-70 (Radioplane)		350
RP-71 (Radioplane)		350
RP-77 (Radioplane)		351
RS2L (Ross)	*(1949-50)*	272c
R S 3 (Reid & Sigrist)	*(1947)*	71c
RT-33 (Lockheed)		324
RWF (see RHEIN-WEST-FLUG FISCHER U COMPANIE)		175
RW.3 Multoplane (RWF)		175
RW.3-A2 (RWF)		175
RW.3-A3 (RWF)		175
RY-3 Liberator	*(1947)*	205c
RADIOPLANE CO. (U.S.A.)		349
Raider C 125 (Northrop)	*(1951-52)*	277c
Ram-Jet Helicopter (McDonnell)	*(1952-53)*	266
Ranch Wagon (Taylorcraft)		366
Ranger (Bell)		251
Raven (Hiller)		308
RAWDON BROTHERS AIRCRAFT, INC. (U.S.A.)		351
REGENT AIRCRAFT, INC. (U.S.A.)	*(1954-55)*	287
Regulus I (Chance Vought)		268
Regulus II (Chance Vought)		269
Reporter R-13A (Northrop)	*(1948)*	308c
REPUBLIC AVIATION CORPORATION (U.S.A.)		352
Rescuer (Vertol)	*(1956-57)*	345
Retriever (Vertol)		370
REY (see Société des Avions Francois Rey)	*(1952-53)*	126
RHEIN-WEST-FLUG FISCHER U. COMPANIE (Germany)		175
RIDDLE AIRLINES, INC. (U.S.A.)		354
RILEY AIRCRAFT COMPANY (U.S.A.)	*(1953-54)*	272
Riley (Temco)	*(1956-57)*	343
Riley Twin (Temco)		368
ROBERTSON DEVELOPMENT CORPORATION (U.S.A.)	*(1954-55)*	290
Rocket (Regent)	*(1954-55)*	287
Rocket 185	*(1947)*	285c
ROE, A. V. & CO., LTD. (G.B.)		55
Rohr M.O.1	*(1947)*	285c
Roitelet (J.D.M.)	*(1951-52)*	127c
Rondone (Ambrosini)		184
Rossiya (Tupolev)		220
ROTOR-CRAFT CORP. (U.S.)		355
Rotorcycle (Gyrodyne)		305
Rotodyne (Fairey)		77
Royal Gull (Trecker)		370
Royal Gull Super 200 (Trecker)		370
RYAN AERONAUTICAL COMPANY (U.S.A.)		355

S

S-1B1 (Callair)	*(1956-57)*	245
S2F (Grumman)		302
S.4A (Siebel)	*(1953-54)*	273
S.5 (S.E.C.A.T.)	*(1948)*	153c
S.7 *(Ambrosini)*	*(1955-56)*	167
S.10 (S.I.P.A.)	*(1949-50)*	129c
S.11 Instructor (Fokker)	*(1956-57)*	189
S.12 Instructor (Fokker)	*(1956-57)*	189
S.12 (S.I.P.A.)	*(1954-55)*	153
S.13 (Fokker)	*(1954-55)*	176
S.14 Mach-Trainer (Fokker)		199
S.14/44 (Supermarine)	*(1947)*	84c
S.18 (Saab)	*(1951-52)*	187c
S.20 (S.I.P.A.)	*(1948)*	154c
S.25 Sunderland (Short)	*(1951-52)*	82c
S.25/V Sandringham (Short)	*(1951-52)*	81c
S.28 (Slingsby)	*(1948)*	97c
S.29 (Saab)		236
S.32 (Saab)		234
S.35 Shetland (Short)	*(1949-50)*	79c
S.45 Seaford (Short)	*(1945-46)*	Add.16
S.45A Solent (Short)	*(1951-52)*	81c
S.49 (Ikarus)	*(1954-55)*	300
S-49C (Yugoslavia)		374
S.50 (SABCA)	*(1949-50)*	10c
S.50 (S.I.P.A.)	*(1947)*	134c
S.51 (Sikorsky)	*(1954-55)*	292
S-51 (Westland)	*(1955-56)*	105
S-52-2 (Sikorsky)	*(1953-54)*	274
S-55 (Sikorsky)		358
S-55 (Westland)	*(1955-56)*	107
S-56 (Sikorsky)		360
S-57 (Sikorsky)	*(1956-57)*	337
S-58 (Sikorsky)		361
S-59 (Sikorsky)	*(1956-57)*	338
S.70 (S.I.P.A.)	*(1948)*	154c
S.90 (S.I.P.A.)	*(1948)*	155c
S-103 (Czechoslovakia)		129
S.111 (S.I.P.A.)	*(1951-52)*	140c
S.121 (S.I.P.A.)	*(1954-55)*	153
S-451M (Yugoslavia)		373
S.901 (S.I.P.A.)	*(1951-52)*	140c
S.1001 (Grifo Ambrosini)	*(1951-52)*	152c
S.1002 Trasimenus (Ambrosini)	*(1951-52)*	152c
S.A.1 Sturgeon (Short)	*(1949-50)*	75c
S.A.2 Sturgeon (Short)	*(1955-56)*	94
S.A.4 (Short)	*(1953-54)*	91
SA-3A (Stits)		363
SA-3B (Stits)		364
S.A.6 Sealand (Short)	*(1954-55)*	95
SA-6B (Stits)		363
SA-7 Sky-Coupe (Stits)		363
SA-16 Albatross (Grumman)		304
S.A.103 (Arsenal)	*(1948)*	137c
SAAB (see Svenska Aeroplan A.B.) (Sweden)		233
SABCA (see Société Anonyme Belge de Constructions Aéronautiques		45
S.A.C.A. (see Societa per Azioni Costruzioni Aeronavali)	*(1951-52)*	161c
S.B.2 (Pilatus)	*(1948)*	206c
S.B.3 (Short)	*(1951-52)*	78c
S.B.4 Sherpa (Short)	*(1955-56)*	96
S.B.5 (Short)		99
S.B.6 Seamew (Short)	*(1956-57)*	90
S.B.9 Sturgeon (Short)	*(1954-55)*	94
SC-1 and SC-2 (Curtiss)	*(1948)*	243c
S.C.1 (Short)		99
S C.A.N. (see Société de Constructions de Port-Neuf)	*(1952-53)*	127
S.C.A.N. 20 (S.C.A.N.)	*(1951-52)*	138c
S.C.A.N. 30 (S.C.A.N.)	*(1951-52)*	138c
S.E.120 (Sud-Est)	*(1950-51)*	139c
S.E.161 Languedoc (Sud-Est)	*(1951-52)*	143c
S.E.200 (Sud-Est)	*(1948)*	156c
S.E.210 Caravelle (Sud)		165
S.E.212 Durandal (Sud)		166
S.E.700 (Sud-Est)	*(1947)*	137c
S.E.1010 (Sud-Est)	*(1949-50)*	131c
S.E.1200 (Sud-Est)	*(1949-50)*	132c
S.E.1210 (Sud-Est)	*(1949-50)*	132c
S.E.2010 Armagnac (Sud-Est)	*(1953-54)*	151
S.E.2100 (Sud-Est)	*(1948)*	159c
S.E.2300 (Sud-Est)	*(1948)*	160c
S.E.2310 (Sud-Est)	*(1948)*	161c
S.E.2410 Grognard (Sud-Est)	*(1952-53)*	130
S.E.3000 Helicopter (Sud-Est)	*(1949-50)*	134c
S.E.3101 Helicopter (Sud-Est)	*(1950-51)*	140c
S.E.3110 Helicopter (Sud-Est)	*(1950-51)*	140c
S.E.3120 (Sud-Est)	*(1953-54)*	151
S.E.3130 (Sud)		170
S.E.3200 (Sud)		170
S.E.3140 (Sud)		170
S.E.4000 (Sud-Est)	*(1949-50)*	134c
S.E.5000 Baroudeur (Sud)		167
S.E. X.116 Fonceur (Sud)		167
S.E.C.A.N. (see Société d'Etudes et de Constructions Aéro-Navales	*(1954-55)*	151
S.E.V.I.M.I.A. (see Société Minie) Aviation)	*(1952-53)*	127
SF-23 Sperling (Scheibe)		176
S.F.E.C.M.A.S. (see Société Française d'Etudes et de Constructions de Matériels Aeronautique Specaux)	*(1955-56)*	150
SG-2 (Hungary)	*(1956-57)*	168
SGS 1-21 (Schweizer)	*(1950-51)*	279c
SGS 1-23 Sailplane (Schweizer)		357
SGS 1-26 Sailplane (Schweizer)		358
SGS 2-8 Sailplane (Schweizer)	*(1947)*	289c
SGS 2-12 Sailplane (Schweizer)	*(1947)*	289c
SGU 1-19 (Schweizer)	*(1951-52)*	288c
SGU 2-22 (Schweizer)		357
Sh(a)-10 (Sheremetov)	*(1950-51)*	173c
ShchE-2 (Shcherbakov)	*(1953-54)*	179
Si 204D (Siebel)	*(1945-46)*	146c
Si 222 Super-Hummel (Siebel)		178
SIPA (see Société Industrielle pour l'Aeronautique		163

	PAGE
SIA 200 (Sipa) .. *(1956-57)*	158
SIPA 300 (Sipa) .. *(1956-57)*	158
SIPA 1000 Coccinelle (Sipa) ..	163
SIPA 1100 (Sipa)	163
SK 50 (Saab)	237
SK.1 (Somers Kendall)	102
SM-1 (Poland)	206
SM-62 Snark (Northrop)	345
SM.95 (SIAI-Marchetti) .. *(1951-52)*	162c
SM.101 (SIAI-Marchetti) .. *(1950-51)*	158c
SM.102 (SIAI-Marchetti) .. *(1951-52)*	161c
SNB-5 (Beechcraft) .. *(1955-56)*	217
S.N.C.A.N. (See Nord) .. *(1956-57)*	146
S.N.C.A.S.E. (see Sud-Est) .. *(1955-56)*	158
S.N.C.A.S.O. (see Sud-Ouest) (1955-56)	160
SNECMA (Société Nationale d'Etude et de Constructions de Motors d'Aviation)	164
SNJ Texan (North American) (1948)	304c
S.O. 30 Nene (Sud-Ouest) .. *(1953-54)*	153
S.O. 30C (Sud-Ouest) .. *(1951-52)*	145c
S.O. 30P (Sud-Ouest) .. *(1955-56)*	160
S.O. 93 (Sud-Ouest) .. *(1947)*	141c
S.O. 94 (Sud-Ouest) .. *(1948)*	161c
S.O. 95 Corse II (Sud-Ouest) (1951-52)	146c
S.O. 175 (Sud-Ouest) .. *(1947)*	142c
S.O. 1110 Ariel II (Sud-Ouest) (1951-52)	148c
S.O. 1120 Ariel III (Sud-Ouest) (1954-55)	157
S.O. 1221 (Sud)	170
S.O. 1310 (Sud-Ouest) .. *(1955-56)*	163
S.O. 3050 (Sud-Ouest) .. *(1947)*	143c
S.O. 4000 (Sud-Ouest) .. *(1952-53)*	133c
S.O. 4050 Vautour (Sud)	168
S.O. 6000 (Sud-Ouest) .. *(1951-52)*	147
S.O. 6020 Espadon (Sud-Ouest) (1953-54)	154
S.O. 7010 Pégase (Sud-Ouest) (1950-51)	144c
S.O. 7050 (Sud-Ouest) .. *(1948)*	162c
S.O. 7060 Deauville (Sud-Ouest) (1950-51)	144c
S.O. 8000 (Sud-Ouest) .. *(1949-50)*	136c
S.O. 9000 (Ouest-Aviation) .. *(1956-57)*	154
S.O. 9050 Trident II (Sud) ..	169
S.O. M.1 (Sud-Ouest) .. *(1950-51)*	144c
S.O. M.1 (Sud-Ouest) .. *(1951-52)*	146c
S.O. M.2 (Sud-Ouest) .. *(1952-53)*	133
SR.7B (Stampe Renard)	45
SR.45 Princess (Saunders-Roe) (1955-56)	92
S.R.53 (Saro)	95
SR.A1 (Saunders Roe) .. *(1951-52)*	74c
SRX-1 (Robertson) .. *(1954-55)*	290
S.U.C. 10 Courlis (S.E.C.A.N.) (1951-52)	139c
SZD-8L Jaskolka (Poland) (1956-57)	194
SZD-8*bis* Jazkolka (Poland) ..	207
SZD-9*bis* Bocian (Poland)	207
SZD Kania (Poland)	204
SAAB (see Svenska Aeroplan A.B.) ..	233
Saab-17 .. .. *(1950-51)*	187c
Saab 18 .. .. *(1951-52)*	187c
Saab 21A .. .. *(1951-52)*	187c
Saab 21R .. .. *(1951-52)*	186c
Saab-29	236
Saab-32 Lansen	234
Saab-35 Draken	233
Saab-90 Scandia .. .. *(1956-57)*	219
Saab-91 Safir	237
Saab 210 Draken	233
Sabre (Canadair)	121
Sabre CA-27 (Commonwealth) ..	115
Sabre F-86 (North American) ..	339
Sabreliner (North American) ..	338
Saeta (Hispano)	232
Safari (Frye)	297
Safir (Saab)	237
Sagittario (Ambrosini) .. *(1954-55)*	162
Sagittario 2 (Aerfar)	182
Saiman (see Societa Anonima Industrie Meccaniche Aeronautiche Navali) (1951-52)	161c
Salamandra 53 (Poland)	26
Samaritan (Convair)	280
Samu Geonczy SG.2 .. *(1951-52)*	149c
Sandringham (Short) .. *(1951-52)*	81c
Saracura (I.P.T.) .. *(1951-52)*	12c
SARO (see Saunders-Roe, Ltd.) (1956-57)	87
Satellite (Planet) .. .. *(1948)*	86c
Saturn Light Transport (Lockheed) (1947)	249c
SAUNDERS-ROE LTD. (G.B.) ..	94
Savage AJ (North American) (1955-56)	298
Scandia (Saab)	219
SCHEIBE-FLUGZEUGBAU G.m.b.H. (Germany)	176
Schulmeister (Burgfalke)	172
SCHWEIZER AIRCRAFT CORPORATION (U.S.A.)	357
Scimitar (Supermarine)	102
Scorpion F-89 (Northrop)	344
SCOTTISH AVIATION, LTD. (G.B.)	97
Scout (Boeing) .. .. *(1950-51)*	209c
Sea Attacker (Supermarine) (1948)	99c
Seabird (Taylorcraft)	366
Sea Dart (Convair) .. *(1956-57)*	253
Sea Devon (de Havilland) .. *(1956-57)*	65
Seafang (Supermarine) .. *(1947)*	80c
Seafire (Supermarine) .. *(1951-52)*	86c
Seaford (Short) .. .. *(1948)*	94c
Sea Fury (Hawker) .. *(1955-56)*	85
Seagull (Supermarine) .. *(1951-52)*	87c
Sea Hawk (Armstrong)	49
Sea Hornet (D.H.) .. *(1951-52)*	45c
Sealand (Short) .. .. *(1954-55)*	95
Seamaster (Martin)	332
Seamew (Short) .. .. *(1956-57)*	90
Sea Meteor (Gloster) .. *(1951-52)*	57c
Sea Mosquito (D.H.) .. *(1950-51)*	52c
Sea Otter (Supermarine) .. *(1949-50)*	87c
Sea Prince (Hunting Percival) (1956-57)	85
Seastar (Lockheed)	325
Sea Vampire (D.H.) .. *(1954-55)*	65
Sea Venom (D.H.)	67
Sea Vixen (D.H.)	67
Sedan (Aeronca) .. .. *(1952-53)*	172
Sedbergh (Slingsby)	101
SEIBEL (Helicopter Division Cessna Aircraft Co.) (U.S.A.) .. *(1953-54)*	273
Seminole (Beechcraft)	246
Seneca (Cessna)	266
Sep (Poland) .. .. *(1953-54)*	174
Seven Seas (Douglas)	292
Shackleton (Avro)	57
Shaunee (Vertol)	371
SHCHERBAKOV, S.O. (Russia) ..	186
Sherpa (Short) .. .. *(1955-56)*	96
Shetland (Short) .. .. *(1949-50)*	79c
SHIN MITSUBISHI JUKOGYO K.K. (Japan)	195
SHIN TACHIKAWA KOKUKI K.K.	195
Shooting Star (Lockheed)	324
SHORT BROTHERS & HARLAND LTD. (G.B.)	98
SHOWA HIKOKI KOGYO K.K. (Japan)	195
Shturmovik (Ilyushin) .. *(1955-56)*	191
SIAI-MARCHETTI, SOCIETA PER AZIONI (Italy)	193
SIEBELWERKE-ATG G.m.b.H. ..	177
SIKORSKY AIRCRAFT DIVISION UNITED AIRCRAFT CORPORATION (U.S.A.)	358
Sikumbang (Indonesia)	181
SILVAIRE AIRCRAFT CORPORATION (U.S.A.)	362
Silvaire 8A Sky Pal (Luscombe) (1949-50)	244c
Silvaire 8F (Luscombe) .. *(1949-50*	243c
Silvaire *8-F* (Silvaire)	362
Silvaire T8F Observer (Luscombe) (1949-50)	244c
Silvaire Sedan (Luscombe) .. *(1949-50)*	243c
Silvaire Sprayer (Luscombe) *(1949-50)*	244c
Silver Star (Canadair)	122
Sioux (Bell)	250
SIPA (see Société Industrielle pour l'Aeronautique) .. *(1956-57)*	157
SKANDINAVISK AERO INDUSTRI A/S (Denmark)	134
SkautM.2 (Czechoslovakia) .. *(1951-52)*	109c
Skeeter (Saro)	96
Skimmer (Colonial)	271
Sky (Slingsby)	100
Sky-Coupe (Stits)	363
Skyhawk (Douglas)	285
Skyhawk S-4A (Seibel) .. *(1951-52)*	288c
Skyjeep (Christea) .. *(1951-52)*	37c
Skyknight (Douglas) .. *(1954-55)*	238
Skylancer (Douglas)	284
Skylark (Robertson) .. *(1954-55)*	290
Skylark 2 (Slingsby)	100
Skylark 3B (Slingsby)	100
Skymaster (Douglas) .. *(1956-57)*	277
Sky Pal (Luscombe) .. *(1949-50)*	244c
Skyraider (Douglas)	288
Skyray (Douglas)	284
Skyrocket (Douglas) .. *(1954-55)*	236
Skyrocket (Northwest Industries) (1949-50)	96c
Sky Scooter (Thorp) .. *(1950-51)*	285c
Skyshark (Douglas) .. *(1954-55)*	240
Skystreak (Douglas) .. *(1954-55)*	236
Skytrain (Douglas) .. *(1951-52)*	234c
Skywarrior (Douglas)	286
SLINGSBY SAILPLANES LTD (G.B.)	100
Snark (Northrop)	345
SOBEH (Netherlands) .. *(1955-56)*	184
SOCIEDADE CONSTRUTORA AERONAUTICA NEIVA, LTDA. (Brazil)	46
SOCIETA AERONAUTICA ITALIANA ING. A. AMBROSINI & C (Italy)	183
SOCIETA ANONIMA INDUSTRIE MECCANICHE AERONAUTICHE NAVALI (Italy) .. *(1951-52)*	157c
SOCIETA PER AZIONI COSTRUZIONI AERONAVALI (Italy) (1951-52)	157c
SOCIÉTÉ ANONYME BELGE DE CONSTRUCTIONS AÉRONAUTIQUES (Belgium)	45
SOCIÉTÉ D'ETUDE ET DE CONSTRUCTIONS AÉRO-NAVALES (France) .. .. *(1954-55)*	151
SOCIÉTÉ D'ETUDES VICTOR MINIÉ AVIATION (see Minié) (France) .. .. *(1953-54)*	142
SOCIÉTÉ DE CONSTRUCTIONS DE AERO NAVALES DE PORTNEUF (France) .. *(1952-53)*	127
SOCIÉTÉ DES AVIONS FRANCOIS REY (France) .. *(1952-53)*	126
SOCIÉTÉ FRANCAISE D'ETUDES ET DE CONSTRUCTIONS DE MATERIELS AÉRONAUTIQUE SPECIAUX (France) (see Nord) (1955-56)	150
SOCIÉTÉ INDUSTRIELLE POUR L'AERONAUTIQUE (France) ..	163
SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DE SUD-EST (France) (1955-56)	158
SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU SUD-OUEST (see Ouest-Aviation) (France) .. *(1956-57)*	152
SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD (S.N.C.A.N.) (France) ..	157
SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTORS D'AVIATION (SNECMA (France)	164
SOhaj 2 LGo25 (Czechoslovakia (1953-54)	120
Sokol MID Falcon (Czechoslovakia) (1955-56)	124
Solent (Short) .. .. *(1951-52)*	81c
SOMERS KENDALL AIRCRAFT, LTD. (G.B.)	103
SOVROMTRACTOR (Rumania) ..	208
Southernaire Model II .. *(1947)*	290c
Southernaire Roadable .. *(1947)*	290c
Sparrowjet M.77 (Miles) .. *(1955-56)*	91
Sparviero (Pasotti)	191
Spearfish (Fairey) .. *(1947)*	42c
Specht (Scheibe)	176
Special de Luxe (Taylorcraft) (1954-55)	296
Sperber (Scheibe)	177
Spatz-55 (Scheibe)	177
Sperling (Scheibe)	176
Spiteful (Supermarine) .. *(1947)*	79c
Spitfire (Supermarine) .. *(1950-51)*	88c
Spitfire Trainer (Supermarine) (1951-52)	86c
Sportsman (Taylorcraft) .. *(1954-55)*	296
Sprayer (Luscombe) .. *(1949-50)*	244c
Sprite (Essex Aero) .. *(1948)*	59c
Squall (Valmet) .. .. *(1956-57)*	125
STAMPE ET RENARD (Belgium) (see Constructions Aéronautiques Stampe et Renard SA)	45
Stampe S.V. 4C (Nord) .. *(1948)*	151c
Standard (Ercoupe) .. *(1949-50)*	222c
Stankov (Yugoslavia) .. *(1952-53)*	247
STARCK, AVIONS ANDRÉ (France) (1953-54)	149
Starfire (Lockheed) .. *(1956-57)*	307
Starfighter (Lockheed)	322
Starflight (Monsted-Vincent) (1949-50)	256c
Starliner (Lockheed)	322
Stinson Voyager 150 .. *(1947)*	293c
STITS AIRCRAFT (U.S.A.) ..	363
Stormovik (Ilyushin) .. *(1948)*	185c
Stout Bushmaster (Hayden) ..	306
Stratocruiser (Boeing)	259
Strato-Courier (Helio)	307
Stratofreighter (Boeing)	260
Stratofortress (Boeing)	257
Stratojet (Boeing)	258
Stratoliner 707 (Boeing)	254
Stratotanker (Boeing)	255
Stratus (I.P.T.) .. *(1951-52)*	13c
STREAK AERO CORPORATION (U.S.A.) .. .. *(1954-55)*	295
Streak-85 (Aero-Flight) .. *(1950-51)*	196c
Streak-125 (Aero-Flight) .. *(1950-51)*	196c
Streak-165 (Aero-Flight) .. *(1952-53)*	171
Streak-225 (Streak) .. *(1954-55)*	295
STROUKOFF AIRCRAFT CORP. (U.S.A.)	364
Student (Miles)	92
Sturgeon (Short) .. .. *(1954-55)*	94
SUD-AVIATION, SOCIÉTÉ NATIONALE, DE CONSTRUCTIONS AÉRONAUTIQUE (France) ..	165
SUD-EST, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES (France) .. *(1956-57)*	153



The far-sighted enterprise of Jessop has resulted in the finest range of Titanium alloys available. Jessops are currently producing the biggest ingots in Europe.

EVIDENCE OF ENTERPRISE

Hylite 10 TITANIUM ALLOY

Commercially pure titanium, supplied to relevant D.T.D. Specifications. Resistance to corrosion with maximum formability and weldability where strength is not critical.

Hylite 20 TITANIUM ALLOY

5% Aluminium, 2½% Tin alloy. An alpha alloy of moderate strength. Being readily weldable and easily formed is suitable for sheet metal work where higher strength than Hylite 10 is required.

Hylite 30 TITANIUM ALLOY

2% Manganese, 2% Aluminium Alloy. A relatively low alloy bridging the gap between commercially pure and the higher strength alloys.

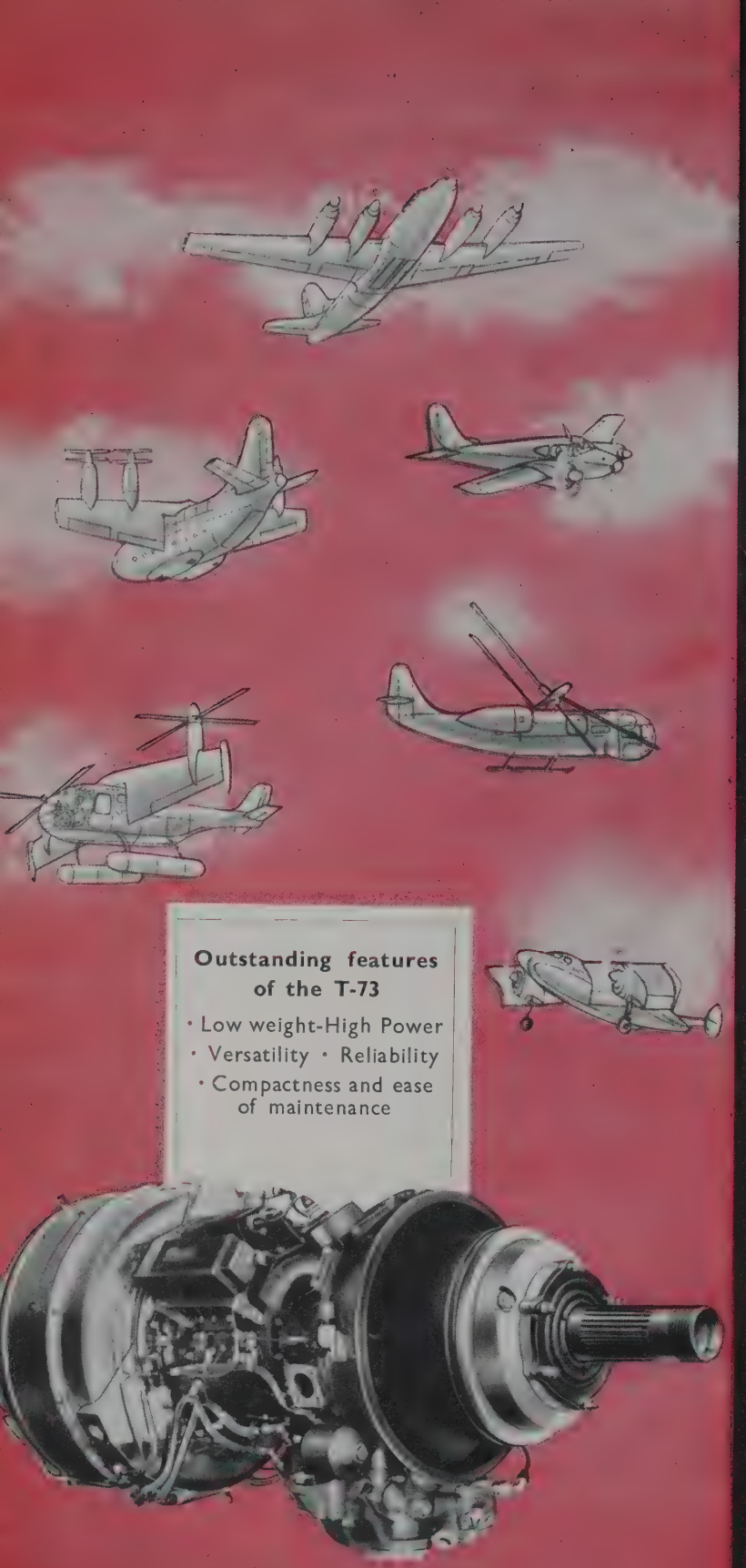
Hylite 40 TITANIUM ALLOY

4% Manganese, 4% Aluminium Alloy. A higher strength alloy suitable for compressor discs and blades.

Hylite 50 TITANIUM ALLOY

A complex aluminium alloy having greater strength combined with excellent creep resisting properties.

WM. JESSOP & SONS LTD. BRIGHTSIDE WORKS, SHEFFIELD



Outstanding features of the T-73

- Low weight-High Power
- Versatility • Reliability
- Compactness and ease of maintenance

When you take gas turbines out of the lab and put them into the air . . .

The New LYCOMING T-53

weighs 75 pounds less than any other complete engine of comparable h.p. for turbo-prop applications!

For the rapidly expanding field of STOL and VTOL aircraft, the new Lycoming T-53 offers a more challenging potential than any turboshaft engine ever developed in the "small-power package" range.

Developed under the sponsorship of the U.S. Army and the U.S. Air Force, the T-53 has already been selected to power the Army's newest Utility 'Copter (Bell XH-40). Bell and Kaman have made their initial flights with Lycoming T-53 turbines. Even now the T-53 is being installed in boats, and stationary power plants are under consideration. Yet it is in the field of turboprop applications that the T-53 might very well offer its most exciting possibilities.

Ready to take to the air, the complete turbo-prop weighs only 460 lbs. and delivers 960 h.p. from a compact 47.6 length × 23 in. diameter. Using a variety of fuels including automotive and aviation types, gasoline and JP-4, it operates at a low 0.655 lbs. per e.s.h.p. per hr. consumption. Rugged design features and unprecedented ease of maintenance guarantee safe operation and long life.

Available with front-end or rear-end power take-off or simultaneous power extraction at both ends, Lycoming's T-53 may solve the turbo-prop problems you're facing *right now* !

Phone, wire or write for turbine information to Lycoming Division, Avco Manufacturing Corp., 550 So. Main St., Stratford, Conn.

avco | Lycoming
defense and industrial products

111 adv.

PAGE

SUD-OUEST, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU (*France*) (*1955-56*) 160
SUKHOI, PAVEL OSIPEVICH (Russia) 202
Sunderland (*Short*) .. (*1951-52*) 82c
Super (*Aero*) .. .. (*1956-57*) 227
Super-18 (Beechcraft) 247
Super DC-3 (*Douglas*) .. (*1951-52*) 232c
Super-T6 (Bacon) 243
Super S.7 (*Ambrosini*) .. (*1956-57*) 170
Super Ace (*Chrislea*) .. (*1951-52*) 37c
Super Aero 45 (Czechoslovakia) .. 132
Super Brigadier (Baumann) .. 244
Super Broussard (Max Holste) .. 156
Super Cadet (*Callair*) .. (*1956-57*) 245
Super Chief (*Aeronca*) .. (*1949-50*) 188c
Super Cigale (Aubert) 138
Super Constellation (Lockheed) .. 319
Super Cruiser (*Piper*) .. (*1948*) 310c
Supercab (*C.A.B.*) .. (*1956-57*) 133
Super Cub (Piper) 3 8
Super-Hummel (Siebel) 178
Super Mystère (Dassault) 145
Super Phrygane (*C.F.A.*) .. (*1953-54*) 130
Superfortress (*Boeing*) .. (*1953-54*) 209
SUPERMARINE (see Vickers-Armstrongs (Aircraft) Ltd. 102
Super Sabre (North American) .. 338
Super Star (*Lockheed*) .. (*1956-57*) 304
Super Ventura (Howard) 310
Survey Prince III/A (*Hunting Percival*) (*1955-56*) 89
SVENSKA AEROPLAN A.B. (Sweden) 233
Swift (Supermarine) 103
Swift (*Temco*) .. .. (*1951-52*) 292c
Swordfish (*Fairey*) .. (*1945-46*) 35c
Sycamore (Bristol) 63
Sylphe (*Fouga*) .. .. (*1954-55*) 139
Szpak-2 (*Poland*) .. (*1951-52*) 166c
Szpak-3 (*Poland*) .. (*1951-52*) 166c
Szpak-4 (*Poland*) .. (*1955-56*) 186

T

T. Mk. 5 Firefly (*Fairey, Australia*) (*1955-56*) 112
T-1 (Rawdon) 351
T-1S (Rawdon) 352
T-1SD (Rawdon) 352
T1F1 (Fuji) 194
T2J (North American) 342
T2V-1 (Lockheed) 325
T-6G Texan (*North American*) (*1952-53*) 234
T-10 (*Carmier*) .. .. (*1947*) 120c
T-11 Sky Scooter (*Thorp*) .. (*1950-51*) 285c
T-18 (*Saab*) .. .. (*1951-52*) 187c
T-28 (North American) 343
T-29 (Convair) 278
T.30 (*Fairchild*) .. .. (*1949-50*) 223c
T.30 (*Guerchais Roche*) .. (*1947*) 121c
T-33 Shooting Star (Lockheed) .. 324
T-34 (Beechcraft) 245
T-35 Buckaroo (*Temco*) .. (*1953-54*) 277
T.35 (*Guerchais Roche*) .. (*1947*) 120c
T-36 (*Beechcraft*) .. (*1952-53*) 174
T-37A (Cessna) 263
T-38 (Northrop) 344
T.39 (*Guerchais Roche*) .. (*1947*) 120c
T.107 (*Guerchais Roche*) .. (*1947*) 121c
T.5.510 (*Nord*) .. .. (*1956-57*) 151
TB-7 (*Tupolev*) .. .. (*1947*) 160c
TBM 3W (*Grumman*) .. (*1951-52*) 246c
TBM 3S (*Grumman*) .. (*1951-52*) 246c
TC-131 (Convair) 280
TE-1 (*Eklund*) .. .. (*1956-57*) 128
TE-1B (*Eklund*) .. (*1956-57*) 124
TE-1 Buckaroo (*Temco*) .. (*1953-54*) 277
TF (Grumman) 303
TF-80 (*Lockheed*) .. (*1949-50*) 240c
TG-1A Frankfurt Glider .. (*1946-47*) 257c
T.H.K, (*see Turk Hava Kurumu Ucak Fabrikasi*) .. .. (*1953-54*) 193
T.H.K.2 (*see M.K.E.K.7*) .. (*1956-57*) 224
T.H.K.5 (*see M.K.E.K.5*) .. (*1956-57*) 224
T.H.K.5A (*see M.K.E.K.5A*) (*1956-57*) 224
T.H.K.10 .. .. (*1948*) 208c
T.H.K.11 .. .. (*1952-53*) 168
T.H.K.13 .. .. (*1952-53*) 168
T.H.K.14 (*see M.K.E.K.6*) (*1956-57*) 224
T.H.K.16 (*see M.K.E.K.2*) (*1955-56*) 211
TM-61 (Martin) 335
TM-76 (Martin) 335
TO-1 (*Lockheed*) .. .. (*1951-52*) 254c
TO-2 (*Lockheed*) .. .. (*1951-52*) 254c
TOM-8 (Czechoslovakia) 129
TS-8 Bies (Poland) 204
TS Jet Trainer (Poland) 205

PAGE

TT-1 (Temco) 367
TT-10 (*Toyo*) .. .. (*1956-57*) 186
TU-2 (*Tupolev*) .. .. (*1953-54*) 181
TU.4 (*Tupolev*) .. .. (*1955-56*) 193
TU-6 (*Tupolev*) .. .. (*1953-54*) 180
TU-7 (*Tupolev*) .. .. (*1947*) 160c
TU-12 (*Tupolev*) .. .. (*1953-54*) 180
TU-70 (*Tupolev*) .. .. (*1951-52*) 176c
TU-14 (Tupolev) 221
TU-16 (Tupolev) 221
TU-104 (Tupolev) 220
TU-110 (Tupolev) 220
TU-114 (Tupolev) 220
TUG-75 (*Tupolev*) .. (*1955-56*) 193
TV2 (Lockheed) 324
Tachihi R-53 (Shin Tachikawa) .. 195
Tachihi R-HM (Shin Tachikawa) .. 195
TACHIKAWA KOKUKI K.K. (Japan) 195
Tagak (Philippine) 202
TALLERAS GENERALES DE AERONAUTICO MILITAR (*Mexico*) (*1952-53*) 144
Tandem Tutor (Slingsby) 101
Tanker (Kingsford Smith) 117
Tanker-Transport (*Boeing*) .. (*1955-56*) 224
Taon (Breguet) 140
Tartuca (*C.V.V.*) .. (*1951-52*) 154c
TAYLORCRAFT, INC. (U.S.A.) 365
Taylorcraft Ace .. .. (*1947*) 294c
Taylorcraft Model 15 .. (*1947*) 295c
Taylorcraft Model 47 .. (*1948*) 122c
TEMCO AIRCRAFT CORPORATION (U.S.A.) 366
Tempest (*Hawker*) .. (*1949-50*) 67c
Tempête (Jurca) 154
Texan (*North American*) .. (*1952-53*) 234
TEXAS (*see Aircraft Manufacturing Co.*) .. .. (*1951-52*) 292c
TEXAS A. & M. COLLEGE, PERSONAL AIRCRAFT RESEARCH CENTER (U.S.A.) 368
TEXAS AIRCRAFT CORPORATION (*U.S.A.*) .. .. (*1952-53*) 245
Thruxton (Jackaroo) 91
Thunderchief (Republic) 352
Thunderflash (Republic) 354
Thunderjet (*Republic*) .. (*1955-56*) 309
Thunderstreak (Republic) .. 353
Tiger (Grumman) 300
Tigercat (*Grumman*) .. (*1948*) 265c
Tipsy Belfair (*Tipsy*) .. (*1947*) 85c
Top Sergeant (*American Helicopter*) (*1951-52*) 196c
Topper (Taylorcraft) 366
Tornado B-45 (*North American*) (*1951-52*) 273c
Tornado P-55 (Partenavia) 190
Tourist (*Taylorcraft*) .. (*1954-55*) 295
Town and Country (*Custer*) (*1956-57*) 263
TOYO KOKU K.K. (Japan) .. 196
Tracer (Grumman) 304
Tracker (Grumman) 302
Trader (Grumman) 303
Tradewind (Convair) 273
Trainer (*Avions Fairey*) .. (*1948*) 12c
TRANSCENDENTAL AIRCRAFT CORP. (U.S.A.) 369
TRANSLAND CO. (U.S.A.) 369
Transporter (*Vertol*) .. (*1956-57*) 346
Trasimenus S.1002 (*Ambrosini*) (*1951-52*) 152c
Travel Air (Beechcraft) 244
Traveler (Champion) 267
Traveler BC12D-65 (*Taylorcraft*) (*1951-52*) 290c
TRECKER AIRCRAFT CORPORATION (U.S.A.) 370
Trener Zlin (*Czechoslovakia*) (*1951-52*) 108c
Trener Mk. 2 Zlin (Czechoslovakia) .. 131
Triana (Hispano) 231
Triciclo-Experimental (*Chile*) (*1953-54*) 103
Trident I (*Ouest-Aviation*) .. (*1956-57*) 154
Trident II (Sud) 169
Tri-Pacer (Piper) 348
Triton (*Sud-Ouest*) .. (*1951-52*) 147c
Tri-Traveler (Champion) 267
Trojan A-2 (*Emigh Trojan*) (*1950-51*) 232c
Trojka (*Yugoslavia*) .. (*1955-56*) 375
Trzmiel (Poland) 206
TSIBIN, P.V. (*Russia*) .. (*1954-55*) 186
Tubbi (*Druine*) .. .. (*1956-57*) 137
Tucano (*Alaparmo*) .. (*1950-51*) 146c
Tudor (*Avro*) .. .. (*1950-51*) 25c
Tuuli-III (Valmet) 136
TUPOLEV, ANDREI NIKOLAEVICH (Russia) 220
Tupolev Twin-jet Bomber (*Tupolev*) (*1948*) 182c
Turbi (Druine) 148
Turboboxcar (Fairchild) 294
Turboliner (*Convair*) .. (*1952-53*) 196
Turbulent (Druine) 148
TURK HAVA KURUMU UCAK FABRIKASI (*Turkey*) .. (*1953-54*) 193

PAGE

Tutor (Slingsby) 101
Twin (Omega) 345
Twin-Bonanza (Beechcraft) 246
Twin-Four (*Langley*) .. (*1948*) 276c
Twin-Mustang (*North American*) (*1950-51*) 266c
Twin Navion (*Temco*) .. (*1954-55*) 296
Twin Pioneer (Scottish Aviation) .. 97
Twin-Quad (*Beechcraft*) .. (*1949-50*) 191c
Twin-Stinson (*Piper*) .. (*1952-53*) 238
Type 5-A Finnmark (*Norway*) (*1949-50*) 155c
Type 21 Mk. 2 (Slingsby) 101
Type 21B (Slingsby) 101
Type 29 (*Slingsby*) .. (*1952-53*) 80
Type 30 (Slingsby) 101
Type 31 (Slingsby) 101
Type 34 (Slingsby) 100
Type 35 (*Guerchais Roche*) (*1948*) 140c
Type 37 (*Slingsby*) .. (*1954-55*) 95
Type 41 (Slingsby) 100
Type 42 Eagle (Slingsby) 100
Type 43 Skylark (Slingsby) .. 100
Type 45 (Slingsby) 100
Type 60 (*Blackburn*) .. (*1955-56*) 55
Type 65 (*Blackburn*) .. (*1955-56*) 55
Type 68 (*Blackburn*) .. (*1952-53*) 42
Type 69 Vertijet (*Ryan*) .. (*1956-57*) 333
Type 76 Deux-Ponts (*Breguet*) (*1952-53*) 111
Type 89 Mercure (*Breguet*) (*1951-52*) 188c
Type 96 Vultur (*Breguet*) .. (*1955-56*) 133
Type 97 Fulgur (*Breguet*) .. (*1951-52*) 118c
Type 111 Gyroplane (*Breguet*) (*1953-54*) 111
Type 156 Beaufighter (*Bristol*) (*1950-51*) 39c
Type 164 Brigand (*Bristol*) (*1951-52*) 36c
Type 167 Brabazon (*Bristol*) (*1952-53*) 45
Type 170 Freighter (*Bristol*) (*1956-57*) 56
Type 171 Helicopter (Bristol) .. 63
Type 173 Helicopter (Bristol) .. 62
Type 175 Britannia (Bristol) .. 60
Type 191 Helicopter (Bristol) .. 63
Type 192 Helicopter (Bristol) .. 63
Type 213 (*Yugoslavia*) .. (*1956-57*) 349
Type 214D (Yugoslavia) .. 375
Type 392 Attacker (*Supermarine*) (*1950-51*) 87c
Type 451-M (*Yugoslavia*) .. (*1956-57*) 347
Type 452-2 (Yugoslavia) 373
Type 508 (*Supermarine*) .. (*1955-56*) 100
Type 510 (*Supermarine*) .. (*1952-53*) 82
Type 522 (Yugoslavia) 373
Type 525 (*Supermarine*) .. (*1955-56*) 100
Type 535 (*Supermarine*) .. (*1952-53*) 82
Type 618 Nene-Viking (*Vickers*) (*1950-51*) 94c
Type 648 Varsity (*Vickers*) .. (*1949-50*) 91c
Type 651 Valetta (*Vickers*) (*1954-55*) 105
Type 668 Varsity (*Vickers*) (*1954-55*) 104
Type 674 Valiant (Vickers) .. 104
Type 696 (Avro) 57
Type 698 (Avro) 56
Type 707 (*Avro*) .. (*1955-56*) 52
Type 763, 765 (Breguet) 141
Type 900 Sailplane (*Breguet*) (*1955-56*) 134
Type 901 (Breguet) 143
Type 902 (Breguet) 143
Type 904 (Breguet) 143
Type 940 (Breguet) 141
Type 941 (Breguet) 141
Type 960 (*Breguet*) .. (*1956-57*) 129
Type 965 (*Breguet*) .. (*1956-57*) 129
Type 1000 (*Vickers*) .. (*1955-56*) 101
Type 1001 (Breguet) 140
Type 1050 (Breguet) 140
Type 1100 (Breguet) 140

U

U-1 (D.H. Canada) 123
U-2 (Lockheed) 324
UC-1 (D.H. Canada) 123
UF Albatross (Grumman) .. 304
UH-4 (*Hiller*) .. .. (*1948*) 269c
UH-12 (Hiller) 308
UH-12B (*Hiller*) .. (*1952-53*) 216
U-IL-28 (*Ilyushin*) .. .. (*1956-57*) 197
U-MIG-15 (*MIG*) .. (*1956-57*) 201
US-5 (*Antonov*) .. .. (*1951-52*) 170c
UT-2 (*Yakovlev*) .. .. (*1951-52*) 176c
Ugur (M.K.E.K.) 239
Ukraina (Antonev) 211
Ultra Light Helicopter (Fairey) .. 77
UNITED AIRCRAFT CORPORATION (*U.S.A.*) .. (*1952-53*) 247
Universal (*Blackburn*) .. (*1955-56*) 55
Universal (*General Aircraft*) (*1948*) 63c
Urubu (*I.A.41*) .. .. (*1956-57*) 39
Utility (M.L.) 91
Utility (Fletcher) 296
Utka (*Mig*) .. .. (*1950-51*) 171c
Utka (*Duck*) .. .. (*1948*) 188c



'Redux' provides a comprehensive system for bonding aircraft components. Its use is fully approved for primary load-bearing structures and there are types available to meet every need:—

(*a*) 'Redux' 775 liquid and powder adhesive for bonding metals and other materials used in aircraft structures. This form of 'Redux' is particularly suitable for use where the bonding of complex shapes or double curvatures is involved.

(*b*) 'Redux' Film 775 consisting of 'Redux' liquid and powder processed into film form between layers of polyethylene. In this one-component form, 'Redux' stands apart in simplicity in use from all other adhesives available for bonding aircraft structures.

(*c*) 'Redux' Film 775 R, similar to Film 775 but incorporating a glass-cloth carrier. This makes possible the fabrication of honeycomb-cored sandwich panels* in only one operation.

Fifty types of aircraft have now made use of 'Redux'

They range from guided missiles to turbine-engined air liners



*Aero Research Ltd. make resin-bonded metal honeycomb cores, suitably vented, for this purpose.

We would like to send you full information on 'Redux' and honeycomb sandwich structures. Much of it is of interest and significance to the designer and production engineer. May we add your name to our mailing list?

'Redux' **ADHESIVES** *for metal aircraft structures*

'Redux' is the registered trade name of the adhesive used in the 'Redux' (patented) bonding process.

Aero Research Limited, *Duxford, Cambridge. Telephone: Sawston 2121.*

AP. 264-244

PAGE

V

V2-1 Weejet (Carma) 262
V-173 (Chance Vought) .. *(1947)* 198c
VB 10 (Arsenal) .. *(1948)* 137c
VC10 (Vickers) 104
VC-121 (Lockheed) 319
VC-131 (Convair) 280
V.G.70 (Arsenal) .. *(1949-50)* 114c
V.G.90 (Arsenal) .. *(1952-53)* 109
VH-II (Valmet) 136
VH-III (Valmet) 137
VJ-21 Volmer Jensen .. *(1947)* 296c
VS-316A (Sikorsky) .. *(1949-50)* 277c
VS-372 (Sikorsky) .. *(1949-50)* 278c
VT-1 (Carma) 262
VTOL (Bell) .. .. *(1956-57)* 224
Vagabond (Piper) .. *(1949-50)* 269c
Valetta (Vickers) .. .. *(1954-55)* 105
Valiant (Vickers) 104
Valmet (see Valtion Metallitchtaat Lentokonetehdas) .. *(1951-52)* 115c
VALMET O/Y, LENTOKONETEHDAS (Finland) 136
VALTION METALLITEHTAAT LENTOKONETEHDAS (Finland) *(1951-52)* 115c
Vampire (D.H.) .. .. *(1954-55)* 65
Vampire Night Fighter (D.H.) *(1954-55)* 66
Vampire Trainer (D.H.) 65
Vanguard (Vickers) 104
Varsity (Vickers) .. *(1954-55)* 104
Vautour (Sud) 168
VELJEKSET KARHUMAKI O/Y (Finland) .. .. *(1955-56)* 128
Venom (D.H.) .. .. *(1956-57)* 62
VERTOL AIRCRAFT COMPANY (CANADA) LTD. (Canada) .. 126
VERTOL AIRCRAFT CORP. (U.S.A.) 370
Vertijet (Ryan) 355
Vertiplane (Ryan) 355
Vertolet (Kamov) .. .. *(1956-57)* 191
VERWALTUNG DER LUFTFAHRT-INDUSTRIE (East Germany) .. 178
VIBERTI (see Ali Viberti S.p.A.) *(1951-52)* 162c
Viceroy (Vickers) .. *(1947)* 86c
VICKERS (see Vickers-Armstrongs (Aircraft) Ltd. 104
VICKERS-ARMSTRONGS (AIRCRAFT) LTD. (G.B.) .. 104
VICKERS-ARMSTRONG (AIRCRAFT) LTD. (Supermarine Div.) (G.B.) 104
Victor (Handley Page) 82
Vihuri (Valmet) 136
Viima Karhumaki) .. *(1948)* 132c
Viking (Vickers) .. .. *(1952-53)* 87
Viscount 700 (Vickers) 106
Viscount 800 108
Viscount 810/840 109
VOLKSEIGENE LUFTFAHRT-INDUSTRIE DER DEUTSCHEN DEMOKRATISCHEN REPUBLIK (East Germany) 178
Voodoo (McDonnell) 329
VOUGHT (see Chance Vought) *(1955-56)* 234
Voyager (Piper) .. .. *(1949-50)* 269c
Vulcan (Avro) 56
Vultur (Breguet) .. .. *(1956-57)* 129

W

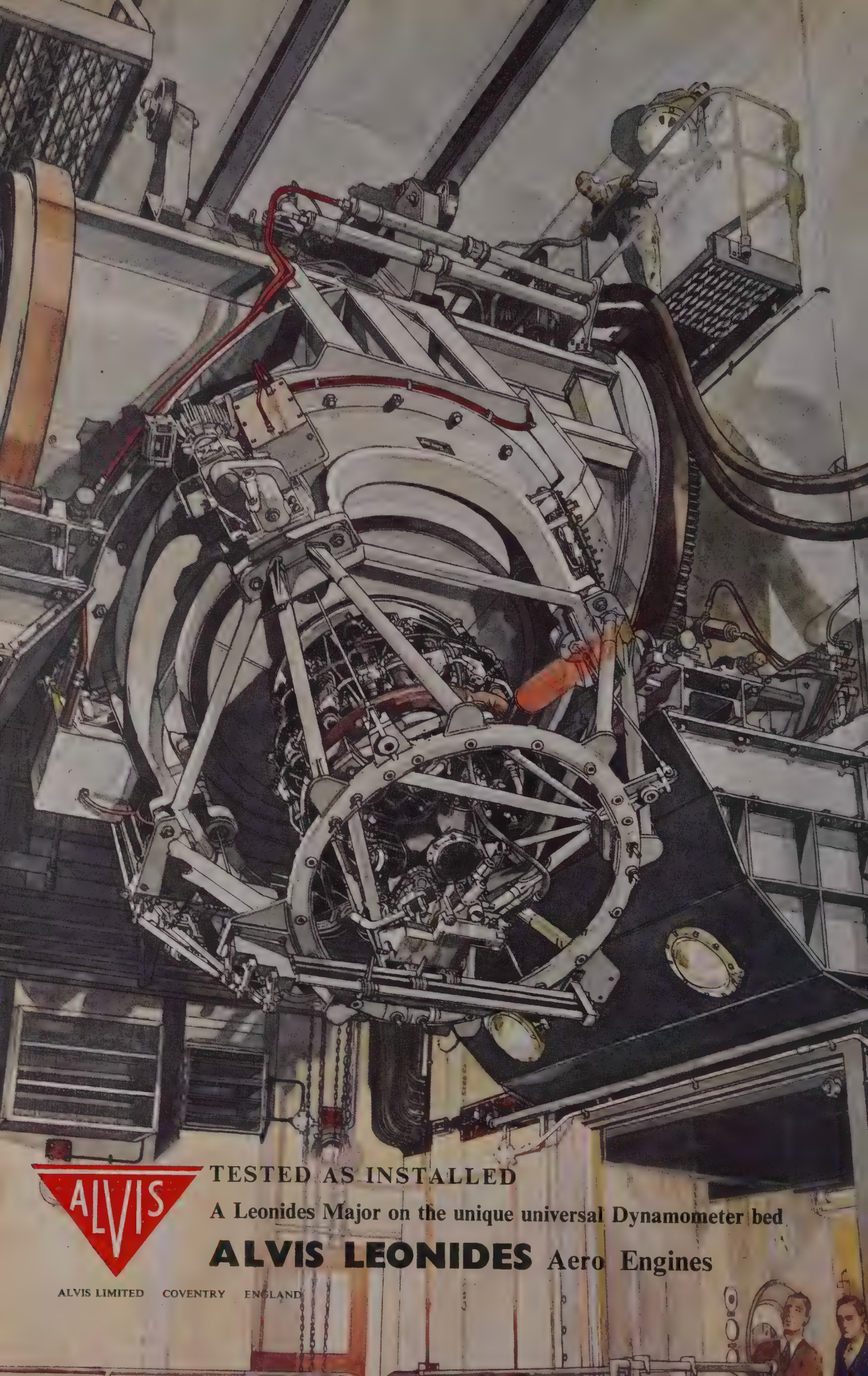
W-6 (Aqua) .. .. *(1950-51)* 198c
W.9 (Cierva) .. .. *(1947)* 30c
W.10 (Cierva) .. .. *(1947)* 30c
W.11T (Saro Cierva) .. *(1951-52)* 76c
W.14 Skeeter (Cierva) .. *(1950-51)* 42c
W.35 (Westland) .. *(1949-50)* 92c
WA-20 (Wassmer) .. *(1956-57)* 162
WB-66 (Douglas) 288
WF-2 (Grumman) 304
WS-101A (Boeing) 257
WS-125A (Convair) 274
WV (Lockheed) 318
Warwick (Vickers) .. *(1947)* 88c
WASSMER, ÉTABLISSEMENTS (France) 171
Wayfarer (Bristol) .. *(1949-50)* 35c
Wee Scotsman (Mooney) .. *(1954-55)* 275
Weejet VT-1 (Carma) 262
Welkin (Westland) .. *(1947)* 89c
WESER, FINANZ-VERWALTUNGS GESELLSCHAFT (Germany) *(1956-57)* 167
"WESER" FLUGZEUGBAU G.m.b.H. (Germany) 178
Wessex (Westland) 112
WESTLAND AIRCRAFT, LTD. (G.B.) 110
Westland-Sikorsky S-51 (Westland) *(1955-56)* 105
Westland-Sikorsky S-55 (Westland) *(1955-56)* 107
Westminster (Westland) 113
Whirlwind (Westland) 111
Whirlaway (Bendix) .. *(1948)* 224c
WIDEROES FLYVESELSKAP OG POLARFLY A/S (Norway) *(1953-54)* 171
Widgeon (Grumman) .. *(1948)* 268c
Widgeon (Westland) 110
Winglet (Eshelman) .. *(1948)* 56c
Winjeel (Commonwealth) 116
Wirraway (Commonwealth) .. *(1947)* 93c
Woomera (Commonwealth) .. *(1947)* 92c
Work Horse (Vertol) 370
Wyvern (Westland) .. *(1956-57)* 101

X

X-1 (Bell) .. .. *(1956-57)* 232
X-2 (Bell) 248
X-3 (Douglas) .. .. *(1956-57)* 247
X-4 (Northrop) .. .. *(1953-54)* 263
X-5 (Bell) .. .. *(1953-54)* 201
X-7 (Lockheed) 328
X-10 (North American) 338
X-13 (Ryan) 355
X-14 (Bell) 248
X-15 (North American) 338
X-18 (Hiller) 307
X.116 Fonceur (Sud) .. *(1956-57)* 159
XAF-1 (Grumman) .. *(1948)* 263c
XAJ-1 (North American) .. *(1948)* 302c
XA2D-1 (Douglas) .. *(1953-54)* 225
XA3D-1 (Douglas) .. *(1952-53)* 201
XA2J-1 (North American) .. *(1953-54)* 261
XA4D-1 (Douglas) .. *(1953-54)* 225
XA-3 (American Helicopter) *(1954-55)* 207
XA-26F (Douglas) .. *(1947)* 225c
XA-38 (Beechcraft) .. *(1947)* 181c
XA-41 (Consolidated Vultee) .. *(1947)* 205c
XA-43 (Curtiss) .. .. *(1947)* 215c
XB-28 (North American) Medium Bomber .. .. *(1947)* 271c
XB-35 (Northrop) .. *(1947)* 273c
XB-36 Consolidated Vultee) .. *(1947)* 206c
XB-38 (Boeing) .. .. *(1947)* 193c
XB-39 (Boeing) .. .. *(1947)* 191c
XB-42 (Douglas) .. *(1947)* 223c
XB-43 (Douglas) .. *(1947)* 224c
XB-44 (Boeing) .. .. *(1947)* 192c
XB-45 (North American) .. *(1948)* 301c
XB-46 (Convair) .. *(1948)* 239c
XB-47 (Boeing) .. .. *(1949-50)* 196c
XB-48 (Martin) .. .. *(1950-51)* 255c
XB-49 (Northrop) .. *(1947)* 274c
XB-51 (Martin) .. *(1952-53)* 229
XB-58 (Convair) .. *(1954-55)* 229
XBQ 3 (Fairchild) .. *(1947)* 228c
XBQ 4 (Interstate) .. *(1947)* 243c
XBTC 2 (Curtiss) .. *(1947)* 213c
XBTD 1 (Douglas) .. *(1947)* 233c
XBT2C-1 (Curtiss) .. *(1947)* 212c
XBT2D-1 (Douglas) .. *(1947)* 222c
XBTM-1 (Martin) .. *(1947)* 262c
XC-69E (Lockheed Constellation) *(1947)* 251c
XC-74 (Douglas) .. *(1947)* 216c
XC-97 (Boeing) .. *(1949-50)* 198c
XC-99 (Convair) .. *(1951-52)* 222c
XC-108 (Boeing) .. *(1947)* 194c
XC-122A (Douglas) .. *(1947)* 217c
XC-120 Pack Plane (Fairchild) *(1951-52)* 236c
XC-122 Avitruc (Chase) .. *(1949-50)* 207c
XC-123 Avitruc (Chase) .. *(1950-51)* 215
XC-123D (Stroukoff) .. *(1956-57)* 316
XC-130 (Lockheed) .. *(1952-53)* 218
XC-133A (Douglas) .. *(1956-57)* 248
XCG-18A (Chase) .. *(1948)* 237c
XCH (McDonnell) .. *(1953-54)* 253
XE-14 (Hispano) .. *(1955-56)* 202
XF2R-1 (Ryan) .. *(1947)* 287c
XF2Y (Convair) .. *(1954-55)* 226
XF3D-1 (Douglas) .. *(1948)* 246c
XF4U-3 (Chance Vought) Corsair *(1947)* 199c
XF5U-1 (Chance Vought) *(1948)* 235
XF6U-1 Pirate (Chance Vought) *(1949-50)* 205c
XF7U-1 Cutlass (Chance Vought) *(1949-50)* 205c
XF8B-1 (Boeing) .. *(1947)* 188c
XF-9F (Grumman) .. *(1948)* 263c
XF10F-1 (Grumman) .. *(1953-54)* 235
XF-11 (Hughes) .. *(1947)* 243c
XF-12 Photographic Reconnaissance Monoplane .. .. *(1947)* 281c
XF 80 (Chance Vought) .. *(1955-56)* 234
XF-82 (North American) .. *(1948)* 302c
XF-84H (Republic) .. *(1956-57)* 333
XF-85 (McDonnell) .. *(1949-50)* 245c
XF-87 (Curtiss) .. .. *(1949-50)* 244c
XF-88 (McDonnell) .. *(1953-54)* 251
XF-89 (Northrop) .. *(1948)* 307c
XF-90 (Lockheed) .. *(1951-52)* 251c
XF-91 (Republic) .. *(1953-54)* 269
XF-92A (Convair) .. *(1953-54)* 216
XF-101 (McDonnell) .. *(1952-53)* 225
XF-102 (Convair) .. *(1953-54)* 216
XF-103 (Republic) .. *(1956-57)* 331
XF-104 (Lockheed) .. *(1955-56)* 279
XF-109 (Ryan) .. .. *(1955-56)* 310
XFG-1 Cornelius .. *(1947)* 210c
XFJ-1 (North American) .. *(1948)* 300c
XFR-4 (Ryan) .. .. *(1948)* 315c
XFV-1 (Lockheed) .. *(1955-56)* 279
XFY-1 (Convair) .. *(1956-57)* 253
XH-8 (Kellett) .. .. *(1949-50)* 236c
XH-10 (Kellett) .. .. *(1949-50)* 236c
XH-13F (Bell) .. .. *(1955-56)* 220
XH-15 (Bell) .. .. *(1953-54)* 203
XH-16 (Kellett) .. .. *(1949-50)* 236c
XH-16 (Piasecki) .. *(1953-54)* 265
XH-17 (Hughes) .. .. *(1953-54)* 241
XH-20 (McDonnell) .. *(1952-53)* 226
XH-26 (American) .. *(1954-55)* 207
XH-39 (Sikorsky) .. *(1956-57)* 338
XH-40 (Bell) 249
XHCH-1 (McDonnell) 331
XHJD-1 Whirlaway (McDonnell) *(1947)* 257c
XHJF-1 (McDonnell) .. *(1949-50)* 248c
XHJP-1 (Piasecki) .. *(1949-50)* 266c
XHJS-1 (Sikorsky) .. *(1949-50)* 275c
XHR-2S (Sikorsky) .. *(1954-55)* 294
XHRH (McDonnell) .. *(1953-54)* 253
XHSL-1 (Bell) .. .. *(1953-54)* 203
XJL-1 (Columbia) .. *(1947)* 200c
XJR-2F (Grumman) .. *(1948)* 267c
XKD4R-1 (Radioplane) 350
XKDB-1 (Beechcraft) 247
XKDT-1 (Temco) 367
XL-14 Maya (Philippine) .. *(1956-57)* 192
XL-15 (Philippine) 202
XL-15 (Boeing) .. *(1947)* 194c
XL-17 (Philippine) 202
XL-19 (Cessna) .. *(1955-56)* 231
XL-25 (McDonnell) .. *(1953-54)* 253
XM21 Firebee (Ryan) 356
XM-1000 (Molyneux) 117
XNQ-1 (Fairchild) .. *(1949-50)* 223c
XOSE-1 (Edo) .. .. *(1948)* 255c
XP4M-1 (Martin) .. *(1947)* 260c
XP5M-1 (Martin) .. *(1949-50)* 253c
XP5Y-1 (Convair) .. *(1953-54)* 216
XP6M (Martin) .. *(1956-57)* 314
XP-49 (Lockheed) .. *(1947)* 255c
XP-51F (North American) Mustang *(1947)* 269c
XP-51G (North American) *(1947)* 270c
XP-58 (Lockheed) Escort .. *(1947)* 254c
XP-60D (Curtiss) .. *(1947)* 214c
XP-61E (Northrop) .. *(1947)* 276c
XP-62 (Curtiss) .. .. *(1947)* 214c
XP-79B (Northrop) .. *(1947)* 275c
XP-80 Shooting Star .. *(1947)* 248c
XP-81 (Consolidated Vultee) *(1947)* 203c
XP-83 (Bell) .. .. *(1947)* 184c
XP-84 Thunderjet .. *(1947)* 283c
XP-87 (Curtiss) .. .. *(1947)* 214c
XP-88 (McDonnell) .. *(1947)* 237c
XP-89 Constitution .. *(1947)* 257c
XP-90 (Lockheed) .. *(1947)* 247c
XP-91 (Republic) .. *(1948)* 311c
XP-92 (Consolidated Vultee) *(1947)* 202c
XPBM-5A (Martin) Mariner *(1947)* 264c
XQ-4 (Radioplane) 349
XR-8 (Kellett) .. .. *(1947)* 244c
XR-9B (Firestone) .. *(1947)* 230c
XR-11 (Hughes) .. *(1948)* 172c
XR-12 (Republic) .. *(1949-50)* 271c
XRB 49A (Northrop) .. *(1950-51)* 271c
XROE-1 (Hiller) 307
XRON-1 (Gyrodyne) 305
XS-1 (Bell) .. .. *(1947)* 183c
XSN2J-1 (North American) *(1949-50)* 262c
XTB3F-1 (Grumman) .. *(1949-50)* 229c
XV-1 (McDonnell) 331
XV-3 (Bell) 249

Y

Y.A.5 (Blackburn) .. *(1950-51)* 29c
YH-32 (Hiller) 307
Yak-1 (Yakovlev) .. *(1947)* 151c
Yak-3 (Yakovlev) .. *(1950-51)* 179c
Yak-6 (Yakovlev) .. *(1948)* 192c
Yak-7 and 8 (Yakovlev) .. *(1950-51)* 179c
Yak-9P (Yakovlev) .. *(1953-54)* 183
Yak-10 (Yakovlev) .. *(1948)* 194c
Yak-11 (Yakovlev) 224
Yak-11U (Yakovlev) 224
Yak-12 (Yakovlev) .. *(1951-52)* 178c
Yak-12 (Yakovlev) 223
Yak-14 (Yakovlev) .. *(1955-56)* 195
Yak-15 (Yakovlev) .. *(1952-53)* 157
Yak-16 (Yakovlev) .. *(1956-57)* 207



ALVIS

TESTED AS INSTALLED

A Leonides Major on the unique universal Dynamometer bed

ALVIS LEONIDES Aero Engines

ALVIS LIMITED COVENTRY ENGLAND

PAGE

Yak-17 (*Yakovlev*) .. (*1955-56*) 194
Yak-18 (Yakovlev) 222
Yak-18U (Yakovlev) 223
Yak-20 (*Yakovlev*) .. (*1950-51*) 178c
Yak-23 (*Yakovlev*) .. (*1956-57*) 206
Yak-24 (Yakovlev) 222
Yak-25 (Yakovlev) 222
Yak Transport Glider (*Yakovlev*) (*1951-52*) 187c
Y.B.1 (*Blackburn*) .. (*1951-52*) 26c
YB-35 (*Northrop*) .. (*1948*) 306c
YB.49 (*Northrop*) .. (*1950-51*) 270c
YB.60 (*Convair*) .. (*1953-54*) 217
YBQ-2A Fleetwings .. (*1947*) 232c
YC-47F (*Douglas*) .. (*1951-52*) 232c
YC-97 (*Boeing*) .. (*1949-50*) 198c
YC-121 (Lockheed) 319
YC-122C (*Chase*) .. (*1951-52*) 214c
YC-123 (*Chase*) .. (*1951-52*) 215c
YC-123E Pantobase (Stroukoff) .. 365
YC-131 (Convair) 244
YC-134 (Stroukoff) 364
YC-135 (*Convair*) .. (*1953-54*) 221
YF-93 Sabre (*North American*) (*1950-51*) 262c
YF-102 (*Convair*) .. (*1955-56*) 238
YG-20 (*C.A.B.*) .. .. (*1955-56*) 136
YG-30 (*C.A.B.*) .. .. (*1955-56*) 136
YH-12 (*Bell*) .. .. (*1953-54*) 203
YH-13 (*Bell*) .. .. (*1951-52*) 201c

PAGE

YH-15 (*Bell*) .. .. (*1950-51*) 203c
YH-16 (*Vertol*) .. .. (*1956-57*) 346
YH-18 (*Sikorsky*) .. (*1953-54*) 274
YH-24 (*Siebel*) .. .. (*1953-54*) 273
YH-30 (*McCulloch*) .. (*1954-55*) 266
YH-31 (*Doman*) .. (*1955-56*) 246
YH-32 (*Hiller*) .. .. (*1956-57*) 290
YH-41 (Cessna) 266
YL-15 (*Boeing*) .. (*1950-51*) 209c
YL-24 (*Helio*) .. .. (*1954-55*) 255
YP-60E Curtiss .. .. (*1947*) 215c
YPQ-12A Fleetwings .. (*1947*) 232c
YQ-1B (*Radioplane*) .. (*1956-57*) 328
YRB-49A Flying Wing (*Northrop*) (*1951-52*) 277c
YT-34 Mentor (*Beechcraft*) (*1952-53*) 174
YT-35 (*Temco*) .. .. (*1952-53*) 245
YAKOVLEV, ALEKSANDIR SERGEIOVICH (Russia) 222
York (*Avro*) .. .. (*1949-50*) 25c
YUGOSLAVIAN GOVERNMENT FACTORIES 373

Z

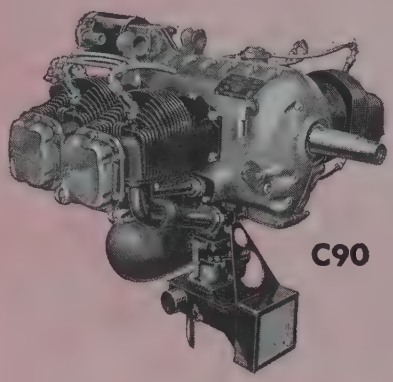
ZPG-2 (Goodyear) 487
ZPG-2W (Goodyear) 488

PAGE

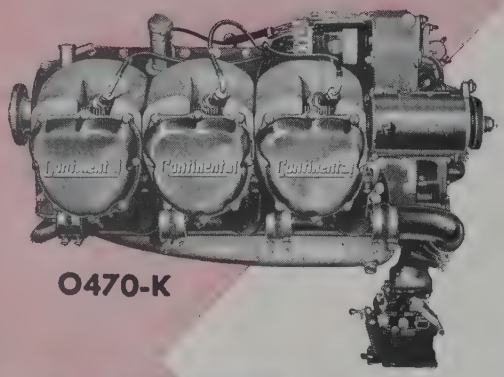
ZSG-4 (Goodyear) 487
ZS2G-1 (Goodyear) 487
Zak-1 (*Poland*) .. .. (*1953-54*) 173
Zak-2 (*Poland*) .. .. (*1953-54*) 173
Zak-3 (*Poland*) .. .. (*1955-56*) 186
Zappata (*Breda*) .. (*1948*) 164c
ZBOROWSKI, BUREAU TECHNIQUE (France) 171
Zlin 22 (*Czechoslovakia*) .. (*1956-57*) 122
Zlin 266 (*Czechoslovakia*) .. (*1956-57*) 121
Zlin 23 Honza (*Czechoslovakia*) (*1949-50*) 107c
Zlin 24 Krajanek (*Czechoslovakia*) (*1949-50*) 107c
Zlin 25 Sohaj (*Czechoslovakia*) (*1949-50*) 107c
Zlin 26 Trener (*Czechoslovakia*) (*1951-52*) 108c
Zlin 30 Kmotr (*Czechoslovakia*) (*1949-50*) 107c
Zlin 122 (*Czechoslovakia*) .. (*1947*) 109c
Zlin 126 (Czechoslovakia) 131
Zlin 381 (*Czechoslovakia*) .. (*1951-52*) 109c
Zlin 226 (Czechoslovakia) 131
Zuch 1 (*Poland*) .. (*1951-52*) 168c
Zugvogel (Scheibe) 177
Zuk (Poland) 205
Zurakowski Helicopter (*Poland*) (*1951-52*) 167c
Zuraw (Poland) 203

CONTINENTAL MEANS DEPENDABLE POWER

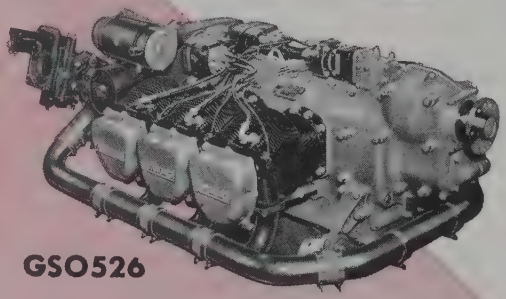
. . . PLUS THE BACKING OF ESTABLISHED AND EXPANDING SERVICE



C90



O470-K



GSO526





Continental's family of aircraft power plants—65 to 320 hp—is broader and more diversified today than ever before. Continentals give you dependability born of more than 52 years' engine-building experience, and backed by a steadily-growing network of ground facilities—factory-approved service and genuine Continental parts—all over the world, wherever people fly. Write for information.

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD · TM REG.

MODEL	HP	RPM	NO. CYL.	WT. COMPLETE	FUEL OCTANE
A65-8F.....	65	2300	4	172	80
C90-12F.....	90	2625	4	186	80
O-300-A & B....	145	2700	6	311	80
E-225.....	225	2650	6	363	80
O-470-K & L....	230	2600	6	438	80
O-470-M.....	240	2600	6	450	91/96
O-470-G.....	240	2600	6	466	91/96
O-470-H.....	240	2600	6	510	91/96
FSO-526-A..... (Helicopter)	270	3000	6	568	91/96
GSO-526-A.....	320	3000	6	560	91/96

Continental Motors Corporation

AIRCRAFT ENGINE DIVISION

MUSKEGON • MICHIGAN

ROTARY WING AIRCRAFT

PAGE

A

AC-12 (Aerotecnica) 225
AC-13 (Aerotecnica) .. *(1955-56)* 197
AC-13A (Aerotecnica) 225
AC-14 (Aerotecnica) 226
Aérocentre N.C. 1002 Twin-rotor (1948) 135c
Aerocycle (De Lackner) 281
AEROTECNICA S.A. (Spain) .. 225
AGUSTA, COSTRUZIONI AERONAUTICHE GIAVANNI (Italy) (1956-57) 170
Alouette (Sud-Est) .. *(1953-54)* 151
Alouette II (Sud-Est) 170
AMERICAN HELICOPTER COMPANY INC. (U.S.A.) .. *(1954-55)* 206
Ariel (Sud-Ouest) .. *(1951-52)* 148c
Ariel III (Sud-Ouest) .. *(1954-55* 157
Army Mule (Vertol) 370

B

B-2 (Brantly) 262
B-7 Gyro-Glider (Benson) 252
B-7B Gyro-Boat (Benson) 253
B-7M Gyro-Copter (Benson) .. 253
B-7W Hydro-Glider (Benson) .. 253
BELL HELICOPTER CORPORATION (U.S.A.) 249
Bell 42 .. *(1947)* 186c
Bell 47 (Agusta) .. .. *(1956-57)* 170
Bell 47B-3 Crop-dusting .. *(1948)* 220c
Bell 470 .. .. *(1948)* 221c
Bellairus (Bell) 251
BENSEN AIRCRAFT CORP. (U.S.A.) 252
BRANTLY HELICOPTER CORPORATION (U.S.A.) 261
Brantly Two-seat .. *(1948)* 231c
BREGUET, SOCIETE ANONYME DES AVIONS LOUIS (France) (1952-53) 111
BRISTOL AEROPLANE CO., LTD. (G.B.) 59
Bristol 171 .. .. *(1956-57)* 60
Bristol 173 .. .. *(1956-57)* 58
Bristol 191 .. .. *(1956-57)* 58
Bristol 192 .. .. *(1956-57)* 58
BS-12 Twin (Omega) 345
Buck Private (American Helicopter) (1951-52) 196c
BZ-4 Zuk (Poland) 205

C

C-1 (Capital) .. .. *(1955-56)* 229
CH-1 (Cessna) 266
CANTINIEAU, JEAN (France) (1953-54) 142
CAPITAL HELICOPTER CORPORATION (U.S.A.) .. *(1955-56)* 229
CESKOSLOVENSKE ZAVODY AUTOMOBILOVE A LETECKE (Czechoslovakia) 132
CESSNA AIRCRAFT CO. (U.S.A.) .. 263
Chickasaw (Sikorsky) 358
Choctaw (Sikorsky) 361
CIERVA (see Saunders Roe) *(1951-52)* 73c
Convertiplane (Bell) .. *(1955-56)* 219
Convertiplane (Jacobs) .. *(1955-56)* 270
Convertiplane (McDonnell) .. *(1955-56)* 286
CZECHOSLOVAK AUTOMOBILE AND AIRCRAFT WORKS .. 132

D

DH-4 Aerocycle (De Lackner) .. 281
DE LACKNER HELICOPTERS INC. (U.S.A.) 281
Djinn (Sud) 170
DOMAN HELICOPTERS INC. (U.S.A. 281
Drone (Kaman) 311
Dragonfly (Westland) 110

F

FAIREY AVIATION CO., LTD. (G.B.) 75
Farfadet (Sud-Ouest) .. *(1955-56)* 163
Flying Platform (Hiller) 309
FLYRIDE (see Glenview Metal Products Co.) .. .. *(1956-57)* 281

G

G.11E Gyroplane (Breguet) .. *(1949-50)* 117c
GA-400R-3 Gizmo (Goodyear) .. 299
GA-450 Firestone .. *(1947)* 231c
G.A1KF Fairey Gyrodyne *(1948)* 60c
G.C.A. 2A (Gyrodyne) .. *(1952-53)* 214
PAGE
G.C.A. 2C (Gyrodyne) .. *(1953-54)* 238
G.C.A. 3 (Gyrodyne) .. *(1953-54)* 239
G.C.A. 7 Helidyne (Gyrodyne) *(1951-52)* 247c
G.I.L. Zurakowski Helicopter (Poland) (1951-52) 167c
GMP-1 (Flyride) .. *(1954-55)* 249
GMP-2 (Flyride) .. *(1956-57)* 281
Gizmo (Goodyear) 299
GLENVIEW METAL PRODUCTS CO. (U.S.A.) .. .. *(1956-57)* 281
GOODYEAR AIRCRAFT CORP. (U.S.A.) 298
Gouverner (Sud) 170
Gyro-Boat (Benson) 253
Gyro-Glider (Bensen) 252
Gyro-Copter (Bensen) .. *(1956-57)* 237
Gyrodyne (Fairey) 253
Gyrodyne (Jacobs) .. *(1955-56)* 270
GYRODYNE COMPANY OF AMERICA INC. (U.S.A.) 305
Gyroplane (Breguet) .. *(1949-50)* 117c

H

H-2 (Landgraf) .. .. *(1949-50)* 236c
H-2 (SOBEH) .. .. *(1955-56)* 184
H-2 (N.H.I.) .. .. *(1956-57)* 191
H-3 (N.H.I.) 201
H-4 (Sikorsky) .. .. *(1949-50)* 277
H-5 (Sikorsky) .. .. *(1954-55)* 292
H-12 (Bell) .. .. *(1952-53)* 178
H-13 (Bell) 250
H-13B (Bell) .. .. *(1951-52)* 201c
H-13G (Bell) .. .. *(1955-56)* 220
H-13J (Bell) 251
H-19 (Sikorsky) 358
H-21 (Vertol) 371
H-23 (Hiller) 308
H-25A (Vertol) 370
H-31 (Doman) 281
H-34 (Sikorsky) .. .. *(1956-57)* 337
H-37 (Sikorsky) 360
H-39 (Sikorsky) .. .. *(1955-56)* 314
HC-2 Heli-Baby (Czechoslovakia) .. 132
HJ-1 Hornet (Hiller) 307
HNS-1 (Sikorsky) .. *(1949-50)* 277c
HO2S-1 (Sikorsky) .. *(1949-50)* 278c
HO3S-1 (Sikorsky) .. *(1954-55)* 292
HO4S-1 (Sikorsky) 358
HO5S-1 (Sikorsky) .. *(1953-54)* 274
HOE-1 (Hiller) 307
HOK-1 (Kaman) 311
H.R. Mk. 13 (Bristol) .. *(1953-54)* 59
HRP (Vertol) .. .. *(1956-57)* 345
HR2S-1 (Sikorsky) 360
HRS (Sikorsky) 358
HSL-1 (Bell) 252
HSS-1 (Sikorsky) 361
HTE-1 (Hiller) 308
HTK (Kaman) 311
HTL (Bell) 250
HTL-6 (Bell) .. .. *(1955-56)* 220
HTL-7 (Bell) 251
HU2K-1 (Kaman) 311
HUL-1 (Bell) 251
HUP Retriever (Vertol) 370
HUS-1 (Sikorsky) 361
Hare (Mil) 218
Helidyne (Gyrodyne) .. *(1953-54)* 239
Heli-Baby (Czechoslovakia) .. 132
Heli-Ventor (De Lackner) .. *(1955-56)* 246
Higgins .. .. *(1947)* 241c
Air Horse (Saro Cierva) *(1951-52)* 75c
HILLER HELICOPTERS, INC. (U.S.A.) 307
Hoppi-copter C-1 (Capital) .. *(1955-56)* 229
HOPPI-COPTERS, INC. (U.S.A.) (1953-54) 241
Hornet (Hiller) 307
Horse (Yakovlev) 222
Hound (Mil) 219
Hoverfly (Sikorsky) .. *(1949-50)* 277c
HUGHES AIRCRAFT COMPANY (U.S.A.) .. .. *(1953-54)* 241
HUGHES TOOL COMPANY, AIRCRAFT DIVISION (U.S.A.) .. 310
HUNTING PERCIVAL AIRCRAFT LTD. (G.B.) .. .. *(1955-56)* 86
Hydro-Glider (Bensen) 253

I

I-G (Transcendental) 344
Iroquois (Bell) 249

J

J (Bendix) Experimental .. *(1948)* 224c
J-1 (McDonnell) .. .. *(1950-51)* 253c
J-5 (Hiller) .. .. .. *(1948)* 269c
PAGE
JOV-3 .. .. *(1950-51)* 243c
JACOBS AIRCRAFT ENGINE CO. (U.S.A.) 292
Jet Gyrodyne (Fairey) .. *(1956-57)* 73

K

K (Bendix) Experimental .. *(1948)* 224c
K.17 Vertolet (Kamov) .. *(1955-56)* 191
K-125-A Two-seat .. *(1948)* 273c
K-190 (Kaman) .. .. *(1949-50)* 236c
K-225 (Kaman) .. .. *(1953-54)* 243
K-600 (Kaman) 312
KA-2 (Kellett) .. .. *(1948)* 274c
KH-15 (Kellett) 313
KAMAN AIRCRAFT CORPORATION (U.S.A.) 310
KAMOV, N.I. (Russia) .. *(1956-57)* 199
KELLETT AIRCRAFT CORPORATION (U.S.A.) 312
Kolibrie (N.H.I.) 201
Kotlinski Tzrmie (Poland) 206

L

LZ-1A (Doman) .. *(1949-50)* 213c
LZ-2A Pelican (Doman) .. *(1949-50)* 213c
LZ-4A (Doman) .. *(1952-53)* 197
LZ-5 (Doman) 281
Landgraf H-2 Single-seat .. *(1948)* 275c
Little Henry (McDonnell) .. *(1949-50)* 248c

M

M-14 Helicopter (Marquardt) *(1951-52)* 262c
MC-4 (McCulloch) .. *(1954-55)* 266
MC-101 (Matra-Cantinieau) *(1953-54)* 142
MI-1 (Mil) 218
MI-1U (Mil) 219
MI-3 (Mil) 219
MI-4 (Mil) 219
McCULLOCH MOTORS CORPORATION HELICOPTER DIVISION (U.S.A.) .. .. *(1954-55)* 266
McDONNELL AIRCRAFT CORPORATION (U.S.A.) 328
MARQUARDT AIRCRAFT COMPANY (U.S.A.) .. *(1951-52)* 262
MATRA-CANTINIEAU (France) (1953-54) 142
MIL, MIKHAIL L. (Russia) .. 218
Model 2 (Transcendental) 369
Model 44 (Vertol) 371
Model 47G (Bell) 250
Model 47H (Bell) 251
Model 47J (Bell) 251
Model 61 (Bell) 252
Model 76 (Vertol) 372
Model 82 (McDonnell) 331
Model 86 (McDonnell) 331
Model 200 (Bell) 249
Model 212 (Bell) 249
Model 269 (Hughes) 310
Mojave (Sikorsky) 358
MOLYNEUX HELICOPTER CO., PTY., LTD. (Australia) .. 117

N

NH-160 (Nagler) 336
N.H.I. (see Nederlandse Helicopter Ind. N.V.) 201
NAGLER HELICOPTER COMPANY, INC. (U.S.A.) 336
NEDERLANDSE HELICOPTER IND. N.V.) 201
NORD (S.N.C.A.N.) (France) *(1955-56)* 150
Nord 1700 Norélic Experimental (1948) 149c
Nord 1750 Norelfe .. *(1955-56)* 154
Norelfe (Nord) .. .. *(1955-56)* 154

O

OMEGA AIRCRAFT CORPORATION (U.S.A.) 345
OUEST-AVIATION, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AERO2AUTIPUES (see SUD) (France) 152

P

P.74 (Hunting Percival) .. *(1955-56)* 86
PD-18 (Piasecki) .. *(1955-56)* 301
PD-22 (Piasecki) .. *(1955-56)* 302
PV-3 Rescuer (Piasecki) .. *(1955-56)* 302



For over forty years companies of the Hawker Siddeley Group have pioneered and developed aircraft and aero engines. Today the Group is one of the world's leading aircraft designers and builders, whose aircraft and aero engines are proving their excellence in the air forces of the Free World. For this reason, the work of the Hawker Siddeley Group is of fundamental importance to Britain, in an age when freedom and security against aggression depend more and more upon adequate air power.

A. V. ROE
GLOSTER
ARMSTRONG WHITWORTH
HAWKER
ARMSTRONG SIDDELEY
HAWKSLEY
HAWKER SIDDELEY NUCLEAR POWER
AIR SERVICE TRAINING
TEMPLEWOOD ENGINEERING
HIGH DUTY ALLOYS *and in Canada:*
AVRO AIRCRAFT
ORENDA ENGINES
CANADIAN STEEL IMPROVEMENT
CANADIAN CAR AND FOUNDRY
CANADIAN STEEL FOUNDRIES

Hawker Siddeley Group

18 St. James's Square, London, S.W.1.

PAGE

PV-14 Retriever (Piasecki) .. *(1951-52)* 280c
PV-15 Transporter (Piasecki) *(1955-56)* 302
PV-17 (Piasecki) .. *(1955-56)* 302
Pawnee (Hiller) 309
Pelican (Doman) .. *(1951-52)* 223c
PIASECKI HELICOPTER CORPORATION (U.S.A.) (see Vertol Aircraft Corp.) .. .. *(1955-56)* 345
PIASECKI AIRCRAFT CORPORATION 347
Pinwheel (Rotor-Craft) 355

R

R-4G Sikorsky .. .. *(1947)* 192c
R-5A Sikorsky .. .. *(1947)* 292c
RH-1 (Rotor-Craft) 355
Ram-Jet Helicopter (McDonnell) *(1952-53)* 226
Ranger (Bell) 251
Raven (Hiller) 308
Rescuer (Vertol) .. .. *(1956-57)* 345
Retriever (Vertol) 370
Rotocycle (Gyrodyne) 305
Rotodyne (Fairey) 77
ROTOR-CRAFT CORP. (U.S.A.) .. 355

S

S-4A (Siebel) .. .. *(1953-54)* 273
S-51 (Sikorsky) .. .. *(1954-55)* 292
S-51 (Westland) .. .. *(1955-56)* 105
S-52-2 (Sikorsky) .. *(1953-54)* 274
S-55 (Sikorsky) 358
S-55 (Westland) .. .. *(1955-56)* 107
S-56 (Sikorsky) 360
S-57 (Sikorsky) .. .. *(1955-56)* 314
S-58 (Sikorsky) 361
S-59 (Sikorsky) .. .. *(1956-57)* 338
S.E.700 .. .. *(1947)* 137c
S.E.3000 (Sud-Est) .. *(1950-51)* 140c
S.E.3101 (Sud-Est) .. *(1950-51)* 140c
S.E.3110 (Sud-Est) .. *(1950-51)* 140c
S-E.3120 (Sud-Est) .. *(1953-54)* 151
S.E.3130 (Sud) 170
S.E.3140 (Sud) 170
S.E.3200 (Sud) 170
SM-1 (Poland) 206
S.O.1110 Ariel II (Sud-Ouest) *(1951-52)* 148c
S.O.1120 Ariel III (Sud-Ouest) *(1954-55)* 157
S.O.1221 (Sud) 170
S.O.1310 (Sud-Ouest) .. *(1955-56)* 163
SARO (see Saunders-Roe, Ltd) *(1956-57)* 87
SAUNDERS-ROE LTD. (G.B.) *(1956-57)* 87
SEIBEL (Helicopter Division, Cessna Aircraft Co. (U.S.A.) .. *(1953-54)* 273
Seneca (Cessna) 266
Shaunee (Vertol) 371

PAGE

SIKORSKY AIRCRAFT DIVISION UNITED AIRCRAFT CORPORATION (U.S.A.) 358
Sioux (Bell) 250
Skeeter (Saro) 96
Sky-Hawk S 4A (Seibel) .. *(1951-52)* 288c
SOBEH (Netherlands) .. *(1955-56)* 184
SUD-AVIATION, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES (France) 165
SUD-EST, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU (France) (see Sud) *(1956-57)* 158
SUD-OUEST, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU (see Ouest-aviation) (France) .. *(1956-57)* 152
Sycamore (Bristol) 63
Sznycer-Gottlieb SG V1-D .. *(1948)* 121c

T

Top Sergeant (American Helicopter) *(1951-52)* 196c
TRANSCENDENTAL AIRCRAFT CORP. (U.S.A.) 369
Transporter (Vertol) .. *(1956-57)* 346
Trzmiel (Poland) 206
Twin (Omega) 345
Type 111 Gyroplane (Breguet) *(1952-53)* 112
Type 171 Helicopter (Bristol) .. 63
Type 173 Helicopter (Bristol) .. 62
Type 191 Helicopter (Bristol) .. 63
Type 192 Helicopter (Bristol) .. 63

U

U-1 (D.H. Canada) .. *(1955-56)* 118
UC-1 (D.H. Canada) .. *(1955-56)* 118
UH 4 Commuter (Hiller) .. *(1948)* 269c
UH-12 (Hiller) 308
UH-12B (Hiller) .. *(1952-53)* 216
Ultra Light Helicopter (Fairey) .. 77

V

VS-316A (Sikorsky) .. *(1949-50)* 277c
VS-372 (Sikorsky) .. *(1949-50)* 278c
VERTOL AIRCRAFT CORP. (U.S.A.) 370
VTOL (Bell) .. .. *(1956-57)* 234
Vertolet (Kamov) .. *(1955-56)* 191

W

W.9 (Cierva) .. .. *(1947)* 31c
W-11T (Saro-Cierva) .. *(1951-52)* 76c
W.14 Skeeter (Cierva) .. *(1950-51)* 42c
Wessex (Westland) 112

PAGE

WESTLAND AIRCRAFT LTD. .. 110
Westminster (Westland) 113
Whirlwind (Westland) 111
Widgeon (Westland) 110
Work Horse (Vertol) 371

X

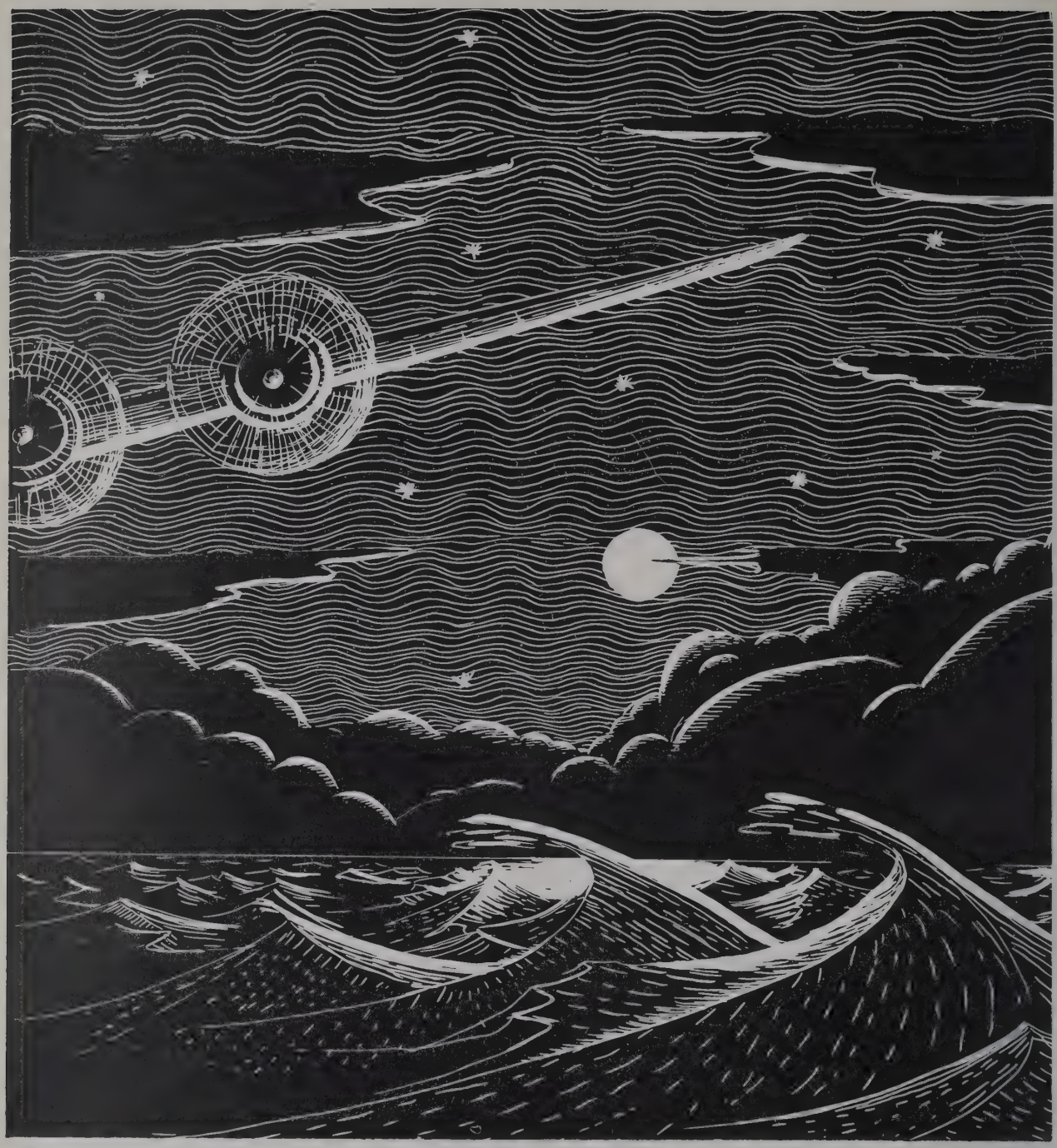
X-18 (Hiller) 307
XA-5 Top Sergeant (American Helicopter) .. .. *(1951-52)* 196c
XA-6 Buck Private (American Helicopter .. .. *(1951-52)* 196c
XA-8 (American Helicopter) *(1954-55)* 207
XCH (McDonnell) .. *(1953-54)* 253
XH-8 (Kellett) .. .. *(1949-50)* 236c
XH-10 (Kellett) .. .. *(1949-50)* 236c
XH-12 (Model 48) Bell .. *(1948)* 222c
XH-13F (Bell) .. .. *(1956-57)* 220
XH-15 (Bell) .. *(1953-54)* 203
XH-16 (Piasecki) .. *(1953-54)* 265
XH-17 (Hughes) .. .. *(1953-54)* 241
XH-17 (Kellett) .. .. *(1949-50)* 236c
XH-20 (McDonnell) .. *(1952-53)* 226
XH-26 (American) .. *(1954-55)* 207
XH39 (Sikorsky) .. *(1956-57)* 338
XH-40 (Bell) 249
XCH-1 (McDonnell) 331
XHJF-1 (McDonnell) .. *(1949-50)* 248c
XHJP-1 (Piasecki) .. *(1949-50)* 266c
XHJS-1 (Sikorsky) .. *(1949-50)* 275c
XHR2S (Sikorsky) .. *(1954-55)* 294
XHRH (McDonnell) .. *(1953-54)* 253
XHSL-1 (Bell) .. .. *(1953-54)* 203
XL-25 (McDonnell) .. *(1953-54)* 253
XM-1000 (Molyneux) 117
XR-8 Kellett .. .. *(1947)* 244c
XR-9B Firestone .. .. *(1947)* 231c
XROE-1 (Hiller) 307
XRON-1 (Gyrodyne) 305
XV-1 (McDonnell) 331
XV-3 (Bell) 249

Y

YH-12 (Bell) .. .. *(1953-54)* 203
YH-13 (Bell) .. .. *(1951-52)* 201
YH-15 (Bell) .. .. *(1950-51)* 203c
YH-16 (Vertol) .. .. *(1956-57)* 346
YH-18 (Sikorsky) .. *(1953-54)* 274
YH-24 (Siebel) .. .. *(1953-54)* 273
YH-30 (McCulloch) .. *(1954-55)* 266
YH-31 (Doman) .. *(1955-56)* 246
YH-32 (Hiller) 307
YH-41 (Cessna) 266
YaK-24 (Yakovlev) 222
YAKOVLEV, A.S. (Russia) .. 222

Z

Zuk (Poland) 205
Zurakowski Helicopter (Poland) *(1951-52)* 167



Setting performance standards throughout the world

PRATT & WHITNEY AIRCRAFT ENGINES

ESSO AVIATION OIL

Combined research and development did it! More than twenty years ago, these two great organisations joined in research and development to produce Esso Aviation Oil. The standard of quality *then*, this oil is *still* setting performance standards in engine lubrication, not only for Pratt & Whitney Aircraft, but for many of the world's major airlines.

This teamwork is still in effect, producing the new lubricants which set performance standards in the jet engines of tomorrow's transports.

ESSO INTERNATIONAL AVIATION PETROLEUM SERVICE

116 adv.

GAS TURBINE ENGINES

PAGE

A

A-65 (Rateau) .. .. *(1947)* 42d
AJ10-24 (Aerojet) 432
ARS.600 Ramjet (Nord) 420
ASM (Armstrong Siddeley) .. 393
ASMD.1 (Armstrong Siddeley) .. 393
ASSa (Armstrong Siddeley) .. 391
ASSc (Armstrong Siddeley) .. 395
ASV (Armstrong Siddeley) .. 394
A.S.X. (Armstrong Siddeley) (1949-50) 8d
Adder (Armstrong Siddeley) (1953-54) 284
AEROJET-GENERAL CORPORATION (U.S.A.) 432
AEROPLANES G. VOISIN, GROUPE O (France) .. .. *(1950-51)* 18d
ALLIS-CHALMERS MANUFACTURING COMPANY (U.S.A.) (1947) 55d
ALLISON DIVISION, GENERAL MOTORS CORPORATION (U.S.A.) 432
Arbizon (Turbomeca) 424
Arius (Turbomeca) .. *(1956-57)* 394
ARMSTRONG SIDDELEY MOTORS LTD. (G.B.) 391
ARSENAL DE L'AERONAUTIQUE (see S.F.E.C.M.A.S.) .. *(1954-55)* 326
Artouste (Blackburn) 397
Artouste (Turboméca) 426
Aspin (Turbomeca) .. *(1954-55)* 329
Astazou (Turbomeca) 425
Atar 8 (SNECMA) 422
Atar 9 (SNECMA) 422
Atar 101 (Voisin) .. *(1950-51)* 18d
Atar 101 (SNECMA) 423
Autan (Turbomeca) 426
Avon (Flygmotor) 431
Avon (Rolls-Royce) 411
A. V. ROE CANADA LTD. (Canada) (see Orenda Engines, Ltd.) .. 415

B

B.E·47 (Bristol) 397
BOl. Olympus (Bristol) 397
BOn. Orion (Bristol) 399
BOr. Orpheus (Bristol) 399
BRJ.5 Thor (Bristol) 402
BT Thor (Bristol) 402
Bastan (Turbomeca) 426
BE.25 (Bristol) .. *(1955-56)* 334
BLACKBURN & GENERAL AIRCRAFT, LTD. (G.B.) 396
BMW STUDIENGESELLSCHAFT FUR TRIEBWERKSBAU G.m.b.H. (Germany) 427
BOEING AIRPLANE COMPANY, INDUSTRIAL PRODUCTS DIVISION (U.S.A.) 435
BRISTOL AERO-ENGINES, LTD. (G.B.) 397
BRISTOL AERO ENGINES LTD. (Canada) 415
BRISTOL AERO ENGINES (WESTERN) LTD. (Canada) .. 415
BRISTOL AEROPLANE CO., LTD. (G.B.) .. .. *(1955-56)* 311

C

C-20 (Marquardt) .. *(1954-55)* 340
CJ-805 (General Electric) .. 438
Chinook (Avro, Canada) .. *(1950-51)* 17d
Clyde (Rolls-Royce) .. *(1950-51)* 14d
CONTINENTAL AVIATION AND ENGINEERING CORP. (U.S.A.) .. 436
Conway (Rolls-Royce) 410
Coupled Naiad (Napier) .. *(1951-52)* 12d
Coupled Proteus (Bristol) .. *(1952-53)* 254
Coupled-Turmo (Turbomeca) *(1956-57)* 369

D

DGJ. Gyron Junior (D.H.) .. 402
DGy. Gyron (D.H.) 402
D.H. (see de Havilland Engine Co. Ltd.) 402
DAIMLER-BENZ AKTIENGESELLSCHAFT (Germany) 427
Dart (Rolls-Royce) 412
DASSAULT, Général Aeronautique MARCEL (France) 418
DE HAVILLAND ENGINE CO., LTD. The (G.B.) 402
Derwent (Rolls-Royce) .. *(1956-57)* 382
Double Mamba (Armstrong Siddeley) 393
Double Scorpion (Napier) 409
Double Naiad (Napier) .. *(1949-50)* 18d
Dovern (Stal) .. .. *(1955-56)* 357

PAGE

E

Ecrivisse (SNECMA) 424
Eland (Napier) 407
Escopette (SNECMA) 424

F

F-2 (Metrovick) (1949-50) 16d
F-5 (Metrovick) .. .. *(1948)* 14d
FABRIQUE NATIONALE D'ARMES DE GUERRE (Belgium) .. 390
FN (see Fabrique, Nationale d'Armes de Guerre S.A.) 390
FAIRCHILD ENGINE DIVISION, FAIRCHILD ENGINE & AIR PLANE CORPN. (U.S.A.) .. 436
FIAT SOCIETA PER AZIONI (Italy) 428
FLADER INC., FREDRIC (U.S.A.) (1952-53) 270
FLYGMOTOR (see Svenska Flygmotor A.B. (Sweden) 431
FUJI JUKOGYO K.K. (Japan) .. 429

G

Gabizo (Turbomeca) 425
Gazelle (Napier) 406
GENERAL ELECTRIC COMPANY, AIRCRAFT GAS TURBINE DIVISION (U.S.A.) 437
Ghost (Flygmotor) 431
Ghost (D.H.) 404
Ghost (Fiat) 428
Goblin (D.H.) 404
Gourdon (Turbomeca) 425
Gyron (D.H.) 402
Gyron Junior (D.H.) 402

H

HEINKEL A. G., ERNST .. 427
HILLER HELICOPTERS, RAMJET DIVISION (U.S.A.) 441
HISPANO-SUIZA, SOCIÉTÉ (France) 419

I

Iroquois (Orenda) 415
ISHIKAWAJIMA JUKOGYO (Japan) 429
Ivchenko (Soviet Union) 430

J

J3-1 (Nippon) 429
J-30 (Westinghouse) .. *(1948)* 71d
J-31 (General Electric) .. *(1947)* 56d
J-33 (Allison) 434
J-34 (Westinghouse) 448
J-35 (General Electric) .. *(1947)* 57d
J-35 (Allison) 434
J-40 (Westinghouse) .. *(1956-57)* 414
J-42 (Pratt & Whitney) .. *(1954-55)* 310
J-44 (Fairchild) 437
J-46 (Westinghouse) 448
J-47 (General Electric) 439
J-48 (Pratt & Whitney) 444
J-52 (Pratt & Whitney) 444
J-54 (Westinghouse) 447
J-55 (Flader) .. .. *(1952-53)* 270
J-57 (Pratt & Whitney) 443
J65 (Wright) 449
J67 (Wright) .. .. *(1955-56)* 372
J.69 (Continental) 436
J-71 (Allison) 432
J-73 (General Electric) 440
J-75 (Pratt & Whitney 443
J79 (General Electric) 438
J.J.E. Models (Japan) .. *(1956-57)* 397
JO-1 (Fuji) .. .. *(1955-56)* 355
JO-1 (Nippon) 429
JAPAN JET-ENGINE CO. (Japan) (1956-57) 397
JATO (Aerojet) .. .. *(1956-57)* 400

K

K (Soviet Union) 430
KAWASAKI KOKUKI (Japan) (1956-57) 397

L

LR2-RM-12 (RMI) .. *(1956-57)* 413
LR8-RM-6 (RMI) 446
LTC1 (Lycoming) 441
LTC4 (Lycoming) 441

PAGE

LU-4 (Soviet Union) 430
Long-life Viper (Armstrong Siddeley) (1956-57) 367
LYCOMING DIVISION OF THE AVCO MANUFACTURING CORP. (U.S.A.) 441

M

M-Series (Soviet Union) .. *(1955-56)* 356
M-012 (Soviet Union) .. *(1955-56)* 356
M-013 (Soviet Union) .. *(1955-56)* 356
M-022 (Soviet Union) .. *(1955-56)* 356
M-028 (Soviet Union) .. *(1955-56)* 356
M.205 (Soviet Union) .. *(1956-57)* 398
M.209 (Soviet Union) 430
MA-19G (Marquardt) 442
MA-20C (Marquardt) 442
M.D. 30 Viper (Dassault) 418
Mamba (Armstrong Siddeley) .. 393
Marboré (Turboméca) 424
Marcadau (Blackburn) 369
Marcadau (Turbomeca) 425
MARQUARDT AIRCRAFT COMPANY (U.S.A.) 442
MENASCO MANUFACTURING COMPANY (U.S.A.) .. *(1947)* 57d
Mercury (Solar) 447
METROVICK (Metropolitan-Vickers Electrical Company Ltd.) (G.B.) (1950-51) 11d
Mikulin 205 (Soviet Union) *(1955-56)* 356
MITSUBISHI KOKUKI (Japan) .. 397
Model 5KS-4500 (Aerojet) 432
Model 8R.J2 (Hiller) 441
Model 12AS-8250B (Aerojet) *(1956-57)* 400
Model 14AS-1000 (Aerojet) *(1956-57)* 400
Model 15KS-1000 (Aerojet) .. 432
Model 140 (Continental) .. *(1956-57)* 405
Model 141 (Continental) 436
Model 160 (Continental) 436
Model 210 (Continental) 436
Model 220 (Continental) 436
Model 320 (Continental) 436
Model 324 (Continental) 436
Model 352 (Continental) 436
Model 354 (Continental) 436
Model 500 Turbojet (Boeing) *(1955-56)* 362
Model 501 (Allison) 434
Model 502 Turboprop (Boeing) .. 404
Model 550 (Allison) 434
Model 4002 (Fiat) 428
Model 6000C4 (Reaction) .. *(1955-56)* 370
Model AJ10-24 (Aerojet) .. *(1956-57)* 400
Model AJ24-1 (Aerojet) .. *(1956-57)* 401
Model YLR45-AJ-1 (Aerojet) *(1956-57)* 401
Model YLR-63-AJ-1 (Aerojet) *(1956-57)* 401

N

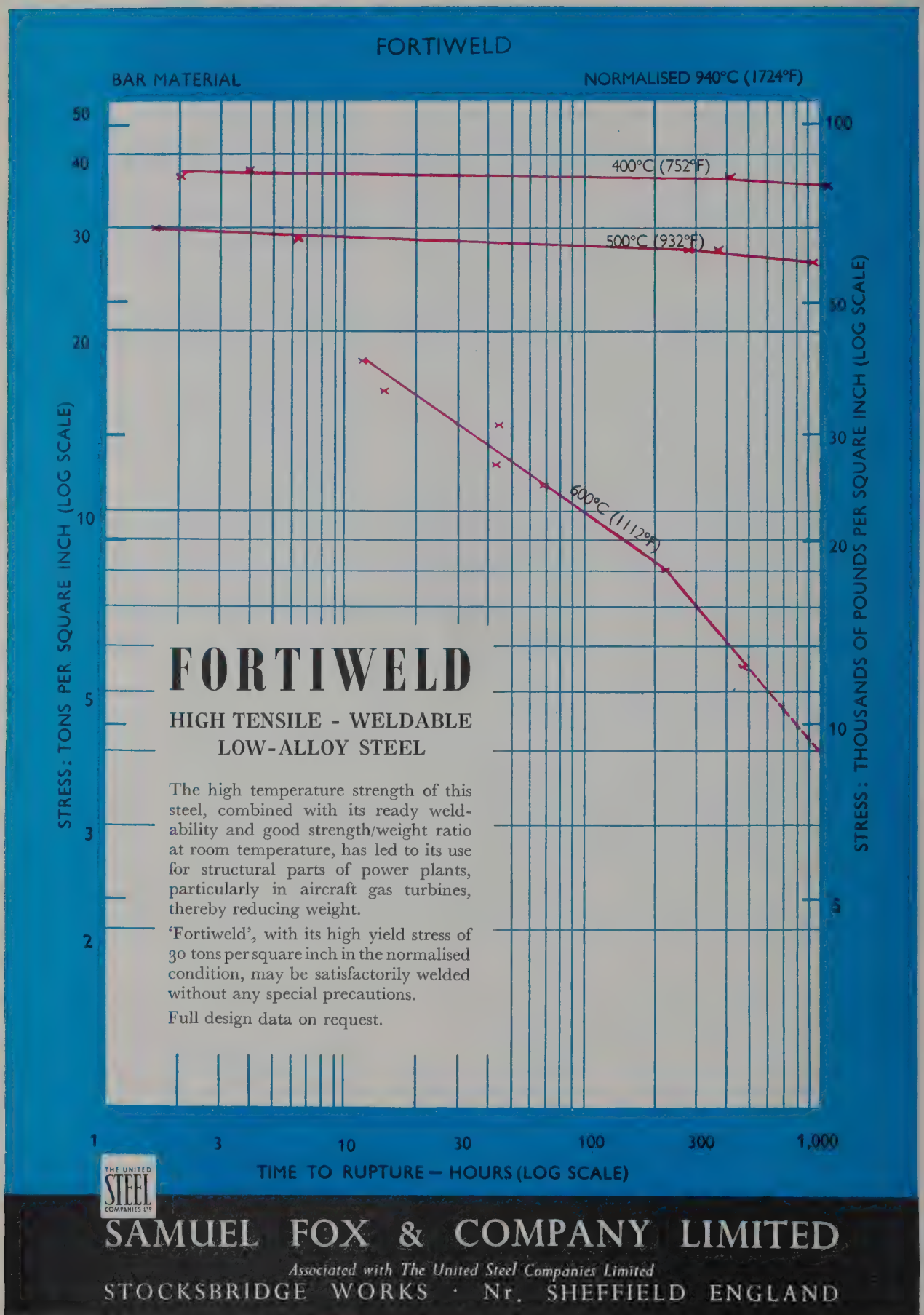
N.El.3 Eland (Napier) 408
NGa. Gazelle (Napier) 406
NK-4 (Soviet Union) 430
N.R.E.17 (Napier) 408
N.R.E.19 (Napier) 408
N.R.J.1 (Napier) 408
NSc. Scorpion (Napier) 409
Naiad (Napier) .. .. *(1951-52)* 13d
NAPIER & SON LIMITED (G.B.) 406
Nene (Rolls-Royce) 412
Nene (Hispano Suiza) 419
Nene 10 (Rolls-Royce Canada) .. 417
NIPPON JET-ENGINE COMPANY (Japan) 429
Nomad (Napier) .. *(1955-56)* 339
NORD, Société Nationale de Constructions Aéronautique du (France) .. 420
NORTHROP-HENDY COMPANY (1947) 58d

O

Olympus (Bristol) 397
ORENDA ENGINES LTD. (Canada) 415
Orenda (Orenda) 415
Orenda (Avro Canada) .. *(1954-55)* 322
Orion (Bristol) 399
Orpheus (Bristol) 399
Oryx (Napier) .. *(1956-57)* 377

P

P.181 (Armstrong Siddeley) .. 392
P.182 (Armstrong Siddeley) .. 392
PT2F (Pratt & Whitney) .. *(1953-54)* 309
Palas (Blackburn) 396


FORTIWELD
BAR MATERIAL
NORMALISED 940°C (1724°F)
400°C (752°F)
500°C (932°F)
600°C (1112°F)
STRESS: TONS PER SQUARE INCH (LOG SCALE)
STRESS: THOUSANDS OF POUNDS PER SQUARE INCH (LOG SCALE)
50
40
30
20
10
5
3
2
100
50
30
20
10
5
1
3
10
30
100
300
1,000
TIME TO RUPTURE — HOURS (LOG SCALE)
FORTIWELD
HIGH TENSILE - WELDABLE
LOW-ALLOY STEEL
The high temperature strength of this steel, combined with its ready weldability and good strength/weight ratio at room temperature, has led to its use for structural parts of power plants, particularly in aircraft gas turbines, thereby reducing weight.
'Fortiweld', with its high yield stress of 30 tons per square inch in the normalised condition, may be satisfactorily welded without any special precautions.
Full design data on request.
THE UNITED STEEL COMPANIES LTD
SAMUEL FOX & COMPANY LIMITED
Associated with The United Steel Companies Limited
STOCKSBRIDGE WORKS · Nr. SHEFFIELD ENGLAND

F 367

PAGE

Palas (Turboméca) 424
Palouste (Blackburn) 397
Palouste (Turboméca) 426
Pimene (Turboméca) .. *(1952-53)* 264
POWER JETS RESEARCH & DEVELOPMENT LTD. (1949-50) 18d
PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION (U.S.A.) .. 443
Proteus (Bristol) 400
Pulse-jets (SNECMA) 424
Pulse-jet (Saro) .. .. *(1955-56)* 344
Pulse-jet (S.N.C.A.N.) .. *(1955-56)* 350
Python (Armstrong Siddeley) *(1955-56)* 327

R

R.7 (Dassault) 418
R-300 (Hispano-Suiza) .. *(1953-54)* 295
R-450 (Hispano-Suiza) .. *(1953-54)* 295
R.800 (Hispano-Suiza) .. *(1956-57)* 388
R.804 (Hispano-Suiza) 419
RA Series (Rolls-Royce) 411
RB.108 (Rolls-Royce) 416
RD-3 (Soviet Union) 430
RD-45 (Soviet Union) 430
RD-500 (Soviet Union) 430
RDa. Series (Rolls-Royce) 412
RJ-30-MA-6 (Marquardt) 442
RJ43 (Marquardt) 442
RM1 (see Reaction Motors, Inc.) .. 446
RM2 Ghost (Flygmotor) 431
RM2B Ghost (Flygmotor) .. 431
RM5 Avon (Flygmotor) 431
RN Series (Rolls-Royce) 412
ROR System (RMI) 446
Ramjet (Hiller) 441
Ramjet (Marquardt) 442
Ramjet (Napier) 408
Ramjet (S.N.C.A.N.) 390
RANGER AIRCRAFT ENGINE DIVISION OF THE FAIRCHILD ENGINE & AIRPLANE CORPORATION (U.S.A.) (1947) .. 58d
RATEAU, SOCIÉTÉ (France) .. 390
REACTION MOTORS INC. (U.S.A.) .. 446
Raven (Bristol) 402
Rocket (Napier) 379
ROLLS-ROYCE LIMITED (G.B.) .. 409
ROLLS-ROYCE OF CANADA LTD. .. 417
ROY FEDDEN LIMITED (G.B.) (1947) 9d

S

Sapphire (Armstrong Siddeley) .. 391
SAUNDERS-ROE, LTD. (G.B.) (1955-56) 344
Savoie (Rateau) .. .. *(1955-56)* 349
Screamer (Armstrong Siddeley) .. 395
Scorpion (Napier) 409
SEPR (Société d'étude de la Propulsion par Réaction) (France) 420
SEPR 25 420
SEPR 65 421
SEPR 66 421
SEPR 78 421
SEPR 251 420

PAGE

SEPR 481 421
SEPR 631 421
SEPR 732 421
SEPR 5053 421
SEPR 5054 421
S.F.E.C.M.A.S. (Société Francaise d'Etudes et de Constructions de Materiels Aeronautiques speciaux) (France) (see S.N.C.A.N.) (1955-56) 349
Short-life Viper (Armstrong Siddeley) (1956-57) 366
Snarler (Armstrong Siddeley) (1955-56) 329
S.N.C.A.N. (Société National de Constructions Aéronautiques du Nord) (France) .. .. *(1956-57)* 90
SNECMA (Société Nationale d'Etude et de Construction de Moteurs d'Aviation) (France) 422
Soar (Rolls-Royce) 410
SOCEMA (Société de Construction et d'Equipments Mecaniques Pour l'Aviation) (France) .. *(1950-51)* 19d
SOLAR AIRCRAFT COMPANY (U.S.A.) 447
Soulor (Turbomeca) 425
Spectre (D.H.) 405
Sprite (D.H.) .. .. *(1954-55)* 315
SRA-1 (Rateau) .. .. *(1948)* 46d
SRA-101 (Rateau) .. .. *(1955-56)* 349
ST.450 (Nord) 420
STAL (see Svenska Turbinfabriks Ab Ljungstrom (Sweden) 431
SUD-OUEST, Société Nationale de Constructions Aeronautiques de, (France) .. .. *(1954-55)* 328
Super Sprite (D.H.) 405
SVENSKA FLYGMOTOR A.B. (Sweden) 431
SVENSKA TURBINFABRIKS AB LJUNGSTROM (Sweden) .. 431

T

T-31 (General Electric) .. *(1949-50)* 30d
T-34 (Pratt & Whitney) 445
T-38 (Allison) .. .. *(1954-55)* 334
T40 (Allison) 434
T49 (Wright) 450
T50 (Boeing) .. .. *(1955-56)* 362
T53 (Lycoming) 441
T55 (Lycoming) 441
T56 (Allison) 433
T57 (Pratt & Whitney) 444
T58 (General Electric) 438
T64 (General Electric) 438
TB. 1000 (SNECMA) .. *(1952-53)* 262
TGA-1 (SOCEMA) .. *(1950-51)* 19d
TGAR-1008 (SOCEMA) .. *(1950-51)* 20d
TJ-38 Zephyr (Wright) 449
TP51J2 (Wright) 450
Tay (Rolls-Royce) .. *(1956-57)* 333
Tay (Hispano-Suiza) 390
TAYLOR TURBINE CORPORATION (U.S.A.) .. *(1947)* 58d
Theseus (Bristol) .. *(1951-52)* 7d
Thor (Bristol) 402
Thrust Reverser (SNECMA) (1955-56) 351
Tramontane (Turbomeca) .. 426

PAGE

Trent (Rolls-Royce) .. *(1948)* 18d
Tromblon (SNECMA) .. *(1954-55)* 297
TUCKER INDUSTRIES INC. (U.S.A.) .. .. *(1948)* 71d
TURBODYNE CORPORATION, THE (U.S.A.) .. *(1950-51)* 29d
TURBOMÉCA, SOCIÉTÉ (France) .. 424
Turbo-Wasp (Pratt & Whitney) (1954-55) 340
Turmo (Blackburn) 396
Turmo (Turbomeca) 426
Two-Dimensional Ramjet (Marquardt) 442
Tyne (Rolls-Royce) 412
Type 022 (Soviet Union) 430

V

VK-1 (Soviet Union 430
VK-5 (Soviet Union) 430
Verdon (Hispano-Suiza) 419
Vesta (SNECMA) .. *(1956-57)* 391
Viper (Armstrong Siddeley) .. 394
Viper (Dassault) 418
Vulcain (SNECMA) .. *(1955-56)* 350

W

WALTER (Germany) .. *(1945-46)* 37d
WEST ENGINEERING COMPANY INC. (U.S.A.) .. *(1948)* 71d
WESTINGHOUSE ELECTRIC CORPORATION, AVIATION GAS TURBINE DIVISION (U.S.A.) .. 447
WOJCICKI (Poland) 429
WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION (U.S A.) 448

X

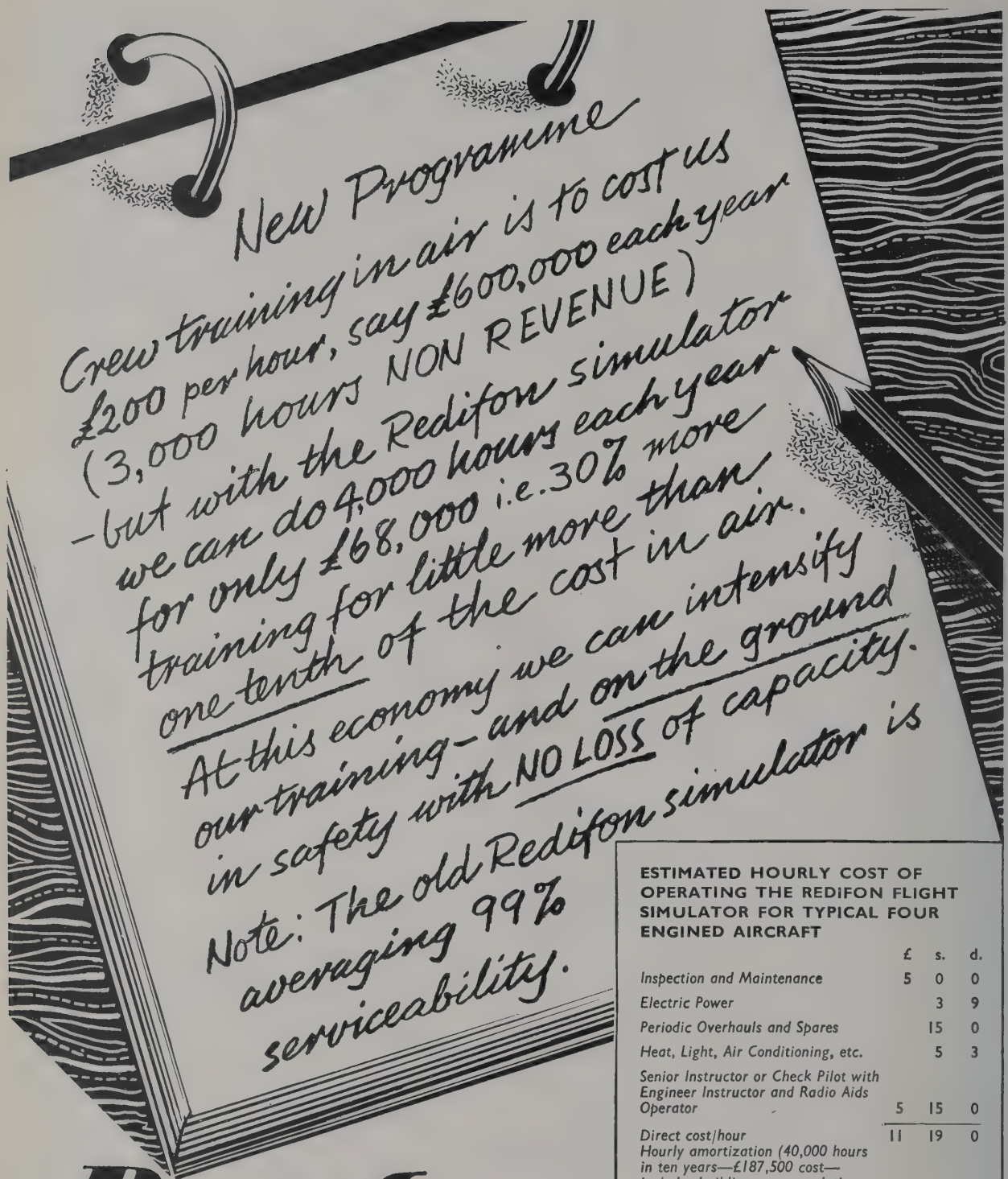
X-9 (Westinghouse) .. *(1947)* 59d
X-19 (Westinghouse) .. *(1947)* 59d
X-84 (General Electric) .. *(1956-57)* 407
X405 (General Electric) 440
XJ81 (Westinghouse) 447
XJ83 (Fairchild) 437
XJ85 (General Electric) 438
XLR10-RM-2 (RMI) 446
XLR25-W-1 (Wright) 450
XJ85 (General Electric) 438
XT-38 (Allison) .. .. *(1950-51)* 22d
XT-40 (Allison) .. .. *(1950-51)* 23d
XT51 (Continental) 436
XT58 (G.E.) .. .. *(1955-56)* 364

Y

YJ-44 (Fairchild) .. *(1952-53)* 270
YT-50 (Boeing) .. .. *(1955-56)* 337
YT-62 Mercury (Solar) 447
YT-66 (Solar) 447

Z

Zephyr (Bristol) 399
Zephyr (Wright) 449
Zubets (Soviet Union) 430



ESTIMATED HOURLY COST OF OPERATING THE REDIFON FLIGHT SIMULATOR FOR TYPICAL FOUR ENGINED AIRCRAFT

	£	s.	d.
Inspection and Maintenance	5	0	0
Electric Power		3	9
Periodic Overhauls and Spares		15	0
Heat, Light, Air Conditioning, etc.		5	3
Senior Instructor or Check Pilot with Engineer Instructor and Radio Aids Operator	5	15	0
Direct cost/hour	11	19	0
Hourly amortization (40,000 hours in ten years—£187,500 cost—includes building accommodation and installation)	4	13	9
Simulator cost/hour	£16	12	9

Redifon
FLIGHT SIMULATORS

Flight Simulator Division
REDIFON LIMITED · CRAWLEY · SUSSEX
A Manufacturing Company in the Rediffusion Group

PISTON ENGINES

PAGE

A

A-1 Alcion (E.N.M.A.) 471
A-38 (Fiat) .. .. *(1947)* 52d
A-65 (Continental) 472
A-76 (Fiat) .. .. *(1947)* 52d
A-83 (Fiat) .. .. *(1947)* 52d
A-100 (Continental) .. *(1947)* 64d
A-1020 (Guiberson) .. *(1947)* 67d
A.B.C. MOTORS LIMITED (G.B.) (1949-50) 36d
AI-4G (Russia) 469
AI-14R (Russia) 469
AI-26B (Russia) 469
ASh-82T (Russia) 469
AERONAUTICA MACCHI (Italy) (1949-50) 70d
AGUSTA, MECCANICA VERGHERA (Italy) 467
AIRCOOLED MOTORS INC. (U.S.A.) 474
Alcion (E.N.M.A.) 471
ALFA ROMEO, SOCIETA PER AZIONI (Italy) 467
ALLISON DIVISION, GENERAL MOTORS CORPORATION, THE (U.S.A.) .. .. *(1947)* 60d
ALVIS LIMITED (G.B.) 451
AM Series Soviet Union) .. *(1951-52)* 61d
AMBROSINI & C., SOCIETA AERONAUTICA ITALIANA (Italy) .. .. *(1952-53)* 295
ANDREWS-CAMERON MANUFACTURING CO. (U.S.A.) (1951-52) 66d
Ardem 4 CO2 (Druine) 463
ARMSTRONG SIDDELEY MOTORS LTD. (G.B.) .. .. *(1952-53)* 277
ARSENAL DE L'AÉRONAUTIQUE (see S.F.E.C.M.A.S.) (France) (1955-56) 329
ASh Series (Soviet Union) .. 469
Asso 6 (Isotta Fraschini) .. *(1951-52)* 60d
ASTER, ATELIERS DE CONSTRUCTION MECHANIQUES L'ASTER (France) .. *(1947)* 42d
Avia Ceskoslovenske Zavody) (1948) 37d
Avro Canada (A. V. Roe Canada Ltd.) (1952-53) 261

B

B-4 Beta (E.N.M.A.) 470
B5 and B54 (Kinner) .. *(1950-51)* 71d
BMW STUDIENGESELLSCHAFT FUR TRIEBWERKSBAU G.m.b.H. (Germany) 466
BARMOTIVE PRODUCTS, INC. (U.S.A.) 478
BEARN (see Société de Construction d'Exploitation de Materiels et de Moteurs (S.C.E.M.M.) (France) (1949-50) 59d
Beta B-4 (E.N.M.A.) 470
BLOCH (see Société des Avions Marcel Bloch) (France) .. *(1947)* 42d
Bombardier (Cirrus) 456
BRISTOL AERO-ENGINES, LTD (G.B.) 453
BRISTOL AEROPLANE COMPANY LTD., The (G.B.) .. *(1955-56)* 346

C

C4-1-E1 (Andrews-Cameron) (1951-52) 66d
C75 (Continental) .. *(1952-53)* 299
C85 (Continental) 472
C90 (Continental) 472
C115 (Continental) .. *(1950-51)* 68d
C125 (Continental) .. *(1953-54)* 299
C145 (Continental) .. *(1655-59)* 394
Centaurus (Bristol) 453
CESKOSLOVENSKE ZAVODY AUTOMOBILOVE A LETECKE (Czechoslovakia) 461
Cheetah (Armstrong Siddeley) (1951-52) 35d
Cicada (Commonwealth) .. *(1955-56)* 356
CIRRUS ENGINE DIVISION OF BLACKBURN & GENERAL AIRCRAFT LTD. (G.B.) 456
Cirrus Major (Cirrus) .. *(1956-57)* 424
Cirrus Minor (Cirrus) .. *(1956-57)* 424
C.N.A. CONSTRUZIONI NAZIONALI AERONAUTIQUE (1950-51) 60d
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. (Australia) .. .. *(1955-56)* 356
CONTINENTAL MOTORS CORPORATION, AIRCRAFT ENGINE DIVISION (U.S.A.) 472

PAGE

Cougar (Armstrong Siddeley) (1947) 15d
COVENTRY VICTOR MOTOR CO. LTD. (G.B.) 457
Cyclone 7 (Lycoming Wright) (1955-56) 399
Cyclone 9 (Lycoming Wright) (1955-56) 399
Cyclone 18 (Wright) 482
Cypselus (Isotta Fraschini) .. *(1951-52)* 60d

D

D-4 (C.N.A. .. .. *(1950-51)* 60d
DAIMLER-BENZ AKTIENGESELLSCHAFT (Germany) .. *(1956-57)* 433
DE HAVILLAND ENGINE COMPANY LTD., The (G.B.) .. 457
Delta (Isotta Fraschini) .. *(1951-52)* 60d
Doris B (Czechoslovakia) 462
Double-Wasp (Pratt & Whitney) .. 480
DRUINE, AVIONS ROGER (France) 463

E

E185 and E255 (Continental) (1956-57) 439
E165 (Continental) .. *(1952-53)* 299
E.N.M.A. (Empresa Nacional de Motores de Aviacion S.A.) 470
Eagle (Rolls-Royce) .. *(1950-51)* 41d
El Gaucho (Instituto Aerotecnico) (1951-52) 33d
El Indio (Instituto Aerotecnico) (1951-52) 33d
ELIZALDE S.A. (see E.N.M.A.) (Spain) .. .. *(1955-56)* 392
EMPRESA NACIONAL DE MOTORES DE AVIACION S.A. (Spain) .. 470

F

F-IV-1 (E.N.M.A.) 471
FSO-470 (Continental) 439
FSO-526 (Continental) 473
FAIRCHILD ENGINE DIVISION, FAIRCHILD ENGINE & AIRPLANE CORPN. (U.S.A.) (1951-52) 67d
FIAT (see Societa per Azioni Fiat Sezione Linaotto (Italy) .. *(1952-53)* 296
Flecha (E.N.M.A.) 471
FLUGZEUGTRIEBWERKS-INDUSTRIE DER DEUTSCHEN DEMOKRATISCHENREPUBLIK (East Germany) 466
Flygmotor F-451-A (Svenska) (1951-52) 65d
Flying Neptune (Coventry Victor) .. 457
FRANKLIN (see Aircooled Motors Inc.) (U.S.A.) 474

G

G-2F (Mathis) .. .. *(1949-50)* 60d
G-4F (Mathis) .. .. *(1949-50)* 60d
G-4 and G-4R (Mathis) .. *(1949-50)* 61d
G-7 and G-7R (Mathis) .. *(1949-50)* 61d
G-8 and G-8R (Mathis) .. *(1949-50)* 61d
G-14R and G-14RS (Mathis) (1949-50) 61d
G-IV Tigre (E.N.M.A.) 471
G.A.40 (Agusta) 467
G.A.70/O (Agusta) 467
G.A.70/V (Agusta) 467
GO-315-A (Continental) 472
GO-435 (Lycoming) 476
GO-480 (Lycoming) 476
Griffon (Rolls-Royce) .. *(1955-56)* 383
GSO-480 (Lycoming) 476
GSO-526 (Continental) 473
GSO-580 (Lycoming) 477
Gipsy Queen (D.H.) 457
Gipsy Major (D.H.) 458
Gnome-Rhone series (Snecma) (1950-51) 56d
Gypagus (Isotta-Franschini) (1951-52) 60d
GUIBERSON DIESEL ENGINE COMPANY, The (U.S.A.) (1947) 67d

H

H-59 (Nelson) .. .. *(1956-57)* 455
H-63 (Barmotive) 478
HEINKEL, A. G. ERNST (Germany) 466
Helicoptere (SNECMA) .. *(1955-56)* 389
Hercules (Bristol) 454
HERMANN ENGINEERING COMPANY (U.S.A.) .. *(1950-51)* 69d
HIRTH MOTOREN G.m.b.H. (Germany) .. .. *(1945-46)* 53d
HISPANO-SUIZA SOCIETE (France) (1951-52) 52d
Horus 4 (Minie) .. .. *(1948)* 52d

PAGE

I

INSTITUTO AEROTECNICO (Argentine) .. .. *(1951-52)* 33d
ISOTTO-FRASCHINI, FABRICA AUTOMOBILI (Itay) .. *(1953-54)* 334
IVCHENKO, A. (Russia) 469

J

JACK & HEINZ INC. (U.S.A.) (1947) 67d
JACOBS AIRCRAFT ENGINE COMPANY (U.S.A.) .. *(1956-57)* 440
JACOBS AIRCRAFT ENGINE COM-
JAMESON AERO ENGINES LTD. (G.B.) .. .. *(1949-50)* 46d
Jameson FF. .. .. *(1949-50)* 46d

K

K.5 (Kinner) .. .. *(1950-51)* 71d
KINNER GLADDEN PRODUCTS CORPN. (Formerly Kinner Motors Inc.) .. .. *(1951-52)* 70d

L

Leonides (Alvis) 451
Leonides Helicopter Engine (Alvis) .. 452
Leonides Major (Alvis) 452
LUTITIA, MOTEURS (France) (1953-54) 327
LYCOMING DIVISION OF THE AVCO MANUFACTURING CORPN. (U.S.A.) 474

M

M332 (Czechoslovakia) 461
M Series (Soviet Union) .. *(1951-52)* 62d
MACCHI (see Aeronautica Macchi) (Italy) .. .. *(1949-50)* 70d
McCULLOCH MOTORS CORPORATION (U.S.A.) 477
MATHIS (see Société Mecamat) (France) (1951-52) 52d
Merlin (Rolls-Royce) .. *(1955-56)* 384
MINIÉ (Victor Minié Aeronautique) (1953-54) 327
Minor 4-III (Czechoslovakia) .. 461
Minor 6-III (Czechoslovakia) .. 462
Minor M332 (Czechoslovakia) .. 461
Minor Sc (Czechoslovakia) 461
Model 4-D 02 (Potez) 463
Model 4-D 30 (Potez) 463
Model 6-D 02 (Potez) 463
Model 6-D 30 (Potez) 464
Model 8-D 30 (Potez) 464
Model 8-D 32 (Potez) 464
Model 335 (Franklin) 474
Model 335 Vertical (Franklin) .. 474
Model 425 (Franklin) 474
Model 4318A (McCulloch) 477
Model 6318 (McCulloch) 478
MONACO ENGINES LTD. (G.B.) (1948) 31d
MORRIS MOTORS LTD. (ENGINES BRANCH) .. *(1948)* 33d
MOTOKOV (Czechoslovakia) 428

N

NAPIER, D. & SON LTD. (G.B.) (1952-53) 284
NARKIEWICZ, DIPL. ING, WICTOR (Poland) 468
Nelson H-63 (Barmotive) .. 478
NELSON (see Barmotive Products, Inc. 478
NELSON SPECIALITY WELDING EQUIPMENT COMPANY (U.S.A.) (1947) 73d
NUFFIELD (see Morris Motors Ltd. Engines Branch) (G.B.) .. *(1948)* 33d

O

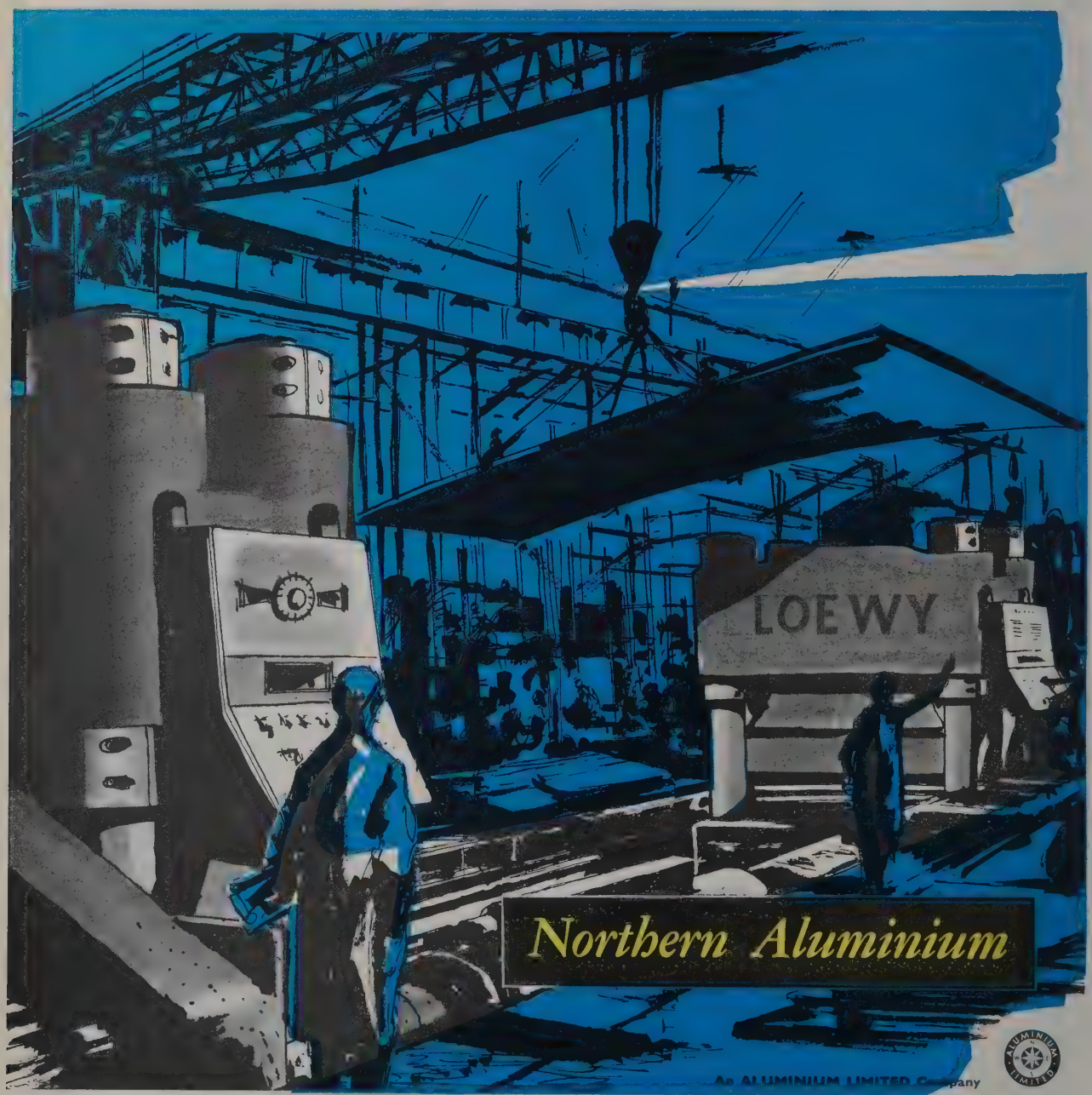
O-100 (McCulloch) 477
O-145 (Lycoming) .. *(1952-53)* 301
O-150 (McCulloch) 478
O-235 (Lycoming) 474
O-240 (Jacobs) .. .. *(1950-51)* 71d
O-290 (Lycoming) 474
O-300 (Continental) 472

4,000 TON PLATE STRETCHER
widens scope
for integral construction

This new plate stretcher at Northern Aluminium Company's Rogerstone Works is a highly significant piece of equipment. It makes available to British aircraft constructors controlled-stretched, heat-treated, light alloy plate in far larger sizes than before, opening up a new perspective in integral construction.

With a pull of 4,000 tons this machine can stretch a solution-heat-treated plate in D.T.D. 5010 alloy with a cross-sectional area of 200 sq. in. Its limiting capacity is plate 10 ft. in width, 50 ft. in length, or 6 in. in thickness; typical sizes of plate to be supplied at once are: 1 in. x 6 ft. x 50 ft.; 2 in. x 6 ft. x 25 ft.; and 3 in. x 6 ft. x 16 ft.

If the availability of large *stretched* plates, with their good metallurgical qualities and freedom from distortion under heavy machining interests you, our Sales Development Division at Banbury, Oxon will be glad to discuss specific problems.



PAGE

O-315 (Continental) .. *(1953-54)* 441
O-320 (Lycoming) 475
O-340 (Lycoming) 475

O-360 (Jacobs) .. .. *(1949-50)* 79d
O-360 (Lycoming) 475
O-435 (Lycoming) 475
O-470 (Continental) 472
O-480 (Lycoming) 475
OMNIPOL LTD. (Czechoslovakia) .. 461

P

P.25 (Ambrosini) .. .. *(1952-53)* 296
P.70 (Ambrosini) .. .. *(1952-53)* 245
PACKARD, THE AIRCRAFT ENGINE DIVISION OF THE PACKARD MOTOR CAR COMPANY (U.S.A.) .. *(1947)* 73d
Persy (Czechoslovakia) .. *(1947)* 41d
PIAGGIO & C. SOCIETA PER AZIONE (Italy) .. *(1949-50)* 70d
PORSCHE K G (Germany) .. 466
POTEZ, SOCIÉTÉ DES AVIONS ET MOTEURS (France) 463
Praga (Czechoslovakia) .. *(1951-52)* 49d
Praga Doris B (Czechoslovakia) .. 462
PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPN. (U.S.A.) .. 479

R

R-5 (Kinner) .. .. *(1950-51)* 71d
R-9a and GR-9a (Continental) (1947) 65d
R-53 (Kinner) .. .. *(1950-51)* 71d
R-56 (Kinner) .. .. *(1951-52)* 70d
R-210 (SNECMA) .. *(1953-54)* 330
R-500 (Warner) .. .. *(1950-51)* 81d
R-550 (Warner) .. .. *(1950-51)* 81d
R-755 Jacobs) 440
R-915 (Jacobs) .. .. *(1951-52)* 69d
R-985 (Pratt & Whitney) .. *(1952-53)* 303
R-1300 (Lycoming Wright) .. *(1955-56)* 399
R-1340 (Pratt & Whitney) .. *(1952-53)* 304
R-1820 (Lycoming Wright) .. *(1955-56)* 396
R-1830 (Pratt & Whitney) .. *(1951-52)* 74d
R-2000 (Pratt & Whitney) 479
R-2180 (Pratt & Whitney) .. *(1950-51)* 78d
R-2600 (Wright) .. *(1948)* 91d
R-2800 (Pratt & Whitney) .. 480
R-3350 (Wright) 482
R-4360 (Pratt & Whitney) .. 480
RANGER AIRCRAFT ENGINES, DIVISION OF THE FAIRCHILD ENGINE & AIRCRAFT CORPN. (U.S.A.) .. *(1948)* 87d

PAGE

REGNIER (Société Anonyme des Etablissements Emile Regnier) (France) .. .. *(1948)* 54d
Regnier (SNECMA) .. *(1956-57)* 432
Renault 12T (SNECMA) 465
ROLLS-ROYCE LIMITED (G.B.) .. 460

S

S-VII Sirio (E.N.M.A.) 470
S-580 (Lycoming) .. *(1947)* 72d
SGV-770 (Ranger) .. *(1948)* 88d
SO-470 (Continental) .. *(1955-56)* 366
SO-480 (Lycoming) 476
SO-580 (Lycoming) 476
Sabre (Napier) .. .. *(1949-50)* 47d
SALMSON, SOCIÉTÉ DES MOTEURS (France) .. *(1955-56)* 320
S.F.E.C.M.A.S. (France) . *(1954-55)* 359
SHVETSOV, A. D. (Russia) .. 469
Sirio S-VII 2 (E.N.M.A.) 470
SNECMA (see Société Nationale d'Etude et de Construction de Moteurs d'Aviation) (France) 465
SOCIETA PER AZIONE FIAT-SEZIONE LINGOTTO (Italy) (1952-53) 296
SOCIÉTE ANONYME DES ETABLISSEMENTS EMILE REGNIER (France) .. .. *(1948)* 54d
SOCIÉTÉ DES AVIONS MARCEL BLOCH (France) .. *(1947)* 42d
SOCIÉTÉ DE CONSTRUCTIONS GUINARD (France) .. *(1947)* 49d
SOCIÉTÉ DE CONSTRUCTION ET D'EXPLOITATION DE MATERIELS ET DE MOTEURS (S.C.E.M.M.) (France) .. *(1949-50)* 59d
SOCIÉTÉ FRANCAIS D'ETUDES ET DE CONSTRUCTIONS DE MATERIELS AERONAUTIQUE SPECIAUX (France) .. *1954-55)* 359
SOCIÉTÉ MECAMAT (France) (1951-52) 52d
SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION (France) (1956-57) 432
SOVIET UNION. The 469
SVENSKA FLYGMOTOR A-B (Sweden) .. .. *(1951-52)* 65d
SWISS LOCOMOTIVE & MACHINE WORKS (Switzerland) (1947) 54d

T

TC18 (Wright) 483
TC6150 (McCulloch) 478

PAGE

Tigre G-IV (E.N.M.A.) 471
Tigre F-IV-35 (E.N.M.A.) .. *(1956-57)* 437
THAHELD DIESEL POWER INC., DIVISION OF THE SHAFTER TOOL WORKS (U.S.A.) (1947) 80d
Tomo 4 & 6 (Czechoslovakia) (1947) 41d
TRAIN (see Société des Constructions Guinard) (France) .. *(1947)* 49d
Turbo-Compound (Wright) .. 483
Turbo-Cylcone 9 (Wright) .. *(1950-51)* 84d
Turbo-Cyclone 18 (Wright) .. *(1953-54)* 347
Twin-Wasp (Pratt & Whitney) .. 479
Type 2 (A.B.C.) .. *(1949-50)* 36d
Type 10 (A.B.C.) .. *(1949-50)* 36d
Type 11 (A.B.C.) .. *(1947)* 13d
Type 678/1 (Porsche) 466

V

V-1710 (Allison) .. .. *(1947)* 61d
V-3420 (Allison) .. .. *(1947)* 62d
VK. Series (Soviet Union) .. *(1951-52)* 62d
VO-435 (Lycoming) 476
VSO-580 (Lycoming) 476
VICTOR MINIÉ AERONAUTIQUE (France) .. .. *(1953-54)* 327

W

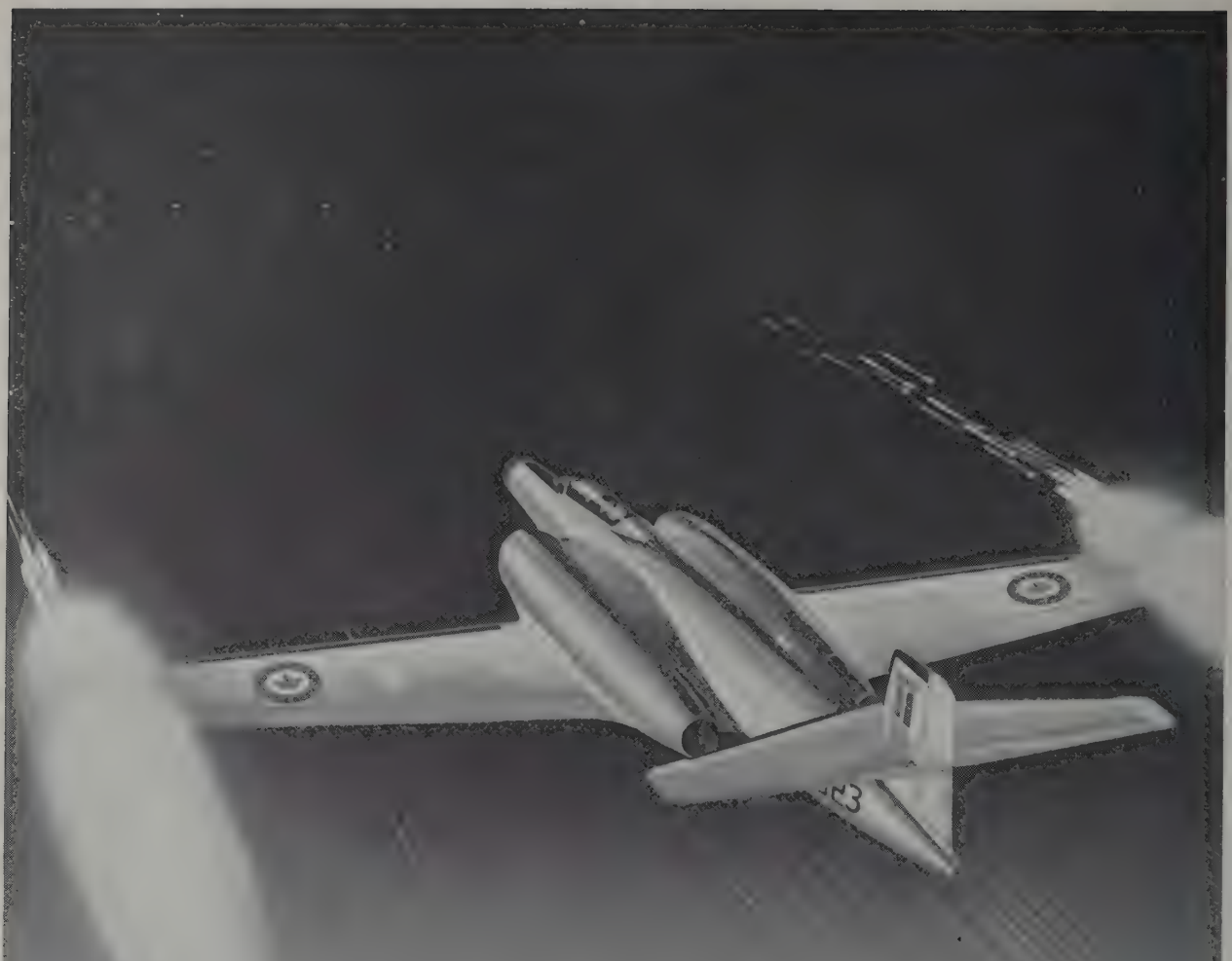
WN-3 (Narkiewicz) 468
Walter A (Czechoslovakia) .. *(1948)* 43d
Walter Minor 4-III (Czechoslovakia) .. 461
Walter Minor 6-III (Czechoslovakia) .. 462
Walter Minor Sc. (Czechoslovakia) .. 463
Walter Mikron III (Czechoslovakia) (1956-57) 428
WARNER DIVISION CLINTON MACHINE CO. (U.S.A.) (1951-52) 77d
Wasp (Pratt & Whitney) .. *(1952-53)* 304
Wasp Junior (Pratt & Whitney) (1952-53) 303
Wasp Major (Pratt & Whitney) .. 480
Wasp Senior (Pratt & Whitney) (1952-53) 306
WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION (U.S.A.) 482

X

XR-7755 (Lycoming) .. *(1947)* 72d

Y

YO-100 (McCulloch) 478



SALVO AT 40,000

This split second in the RCAF's radar-controlled
lead collision course attack technique demonstrates
the most powerful weapon in air defence.
Automatically released, a salvo of rockets from the
Avro CF-100, packing the punch of a destroyer,
boxes the target in a lethal concentration of fire power.
Interceptor squadrons of the RCAF being equipped with the
Mk. 5 variant of the CF-100 . . . capable of operational
performance at high altitude . . . practice rocket firing
day and night, as part of their round-the-clock alert.

AVRO AIRCRAFT LIMITED

MALTON, CANADA

MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

THE NATIONAL MARKINGS OF THE AIR FORCES OF THE WORLD

ARRANGED IN

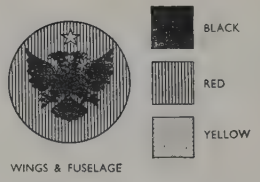
ALPHABETICAL ORDER OF NATIONS

AFGHANISTAN



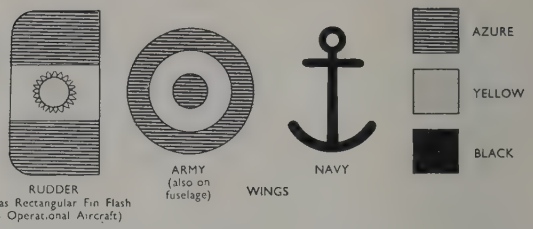
THE ROYAL AFGHAN AIR FORCE

ALBANIA



THE ALBANIAN AIR FORCE

ARGENTINE REPUBLIC



THE ARGENTINE AIR FORCE AND NAVAL AVIATION

AUSTRALIA



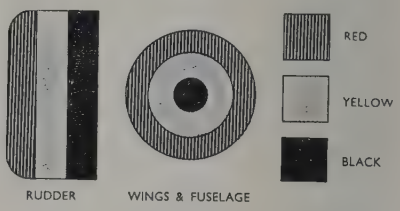
THE ROYAL AUSTRALIAN AIR FORCE

AUSTRIA



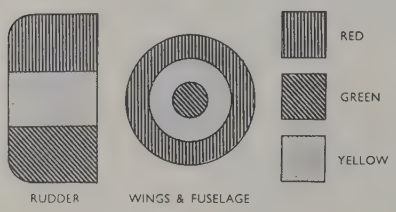
THE AUSTRIAN AIR FORCE

BELGIUM



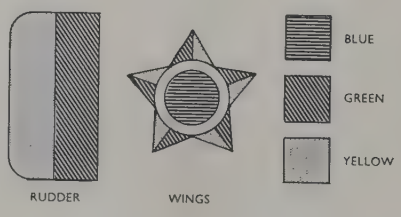
THE ROYAL BELGIAN AIR FORCE

BOLIVIA



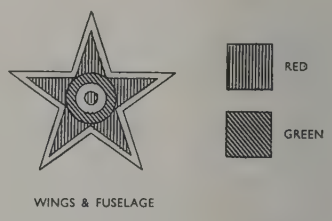
THE BOLIVIAN AIR FORCE

BRAZIL



THE BRAZILIAN AIR FORCE

BULGARIA



THE BULGARIAN AIR FORCE

BURMA



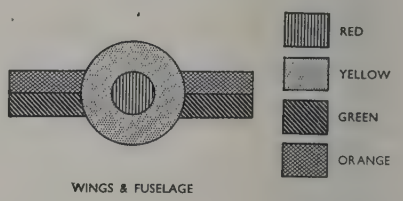
THE BURMA AIR FORCE

CANADA



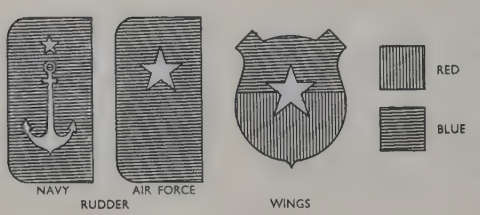
THE ROYAL CANADIAN AIR FORCE AND NAVAL AVIATION

CEYLON



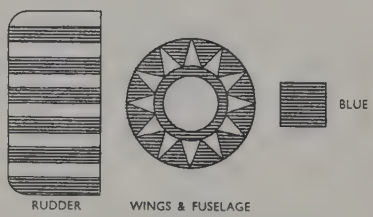
THE CEYLON AIR FORCE

CHILE



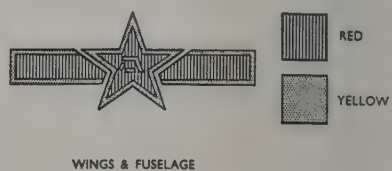
THE CHILEAN AIR FORCE and NAVAL AVIATION

CHINA
(NATIONALIST)



THE CHINESE NATIONALIST AIR FORCE

CHINA
(THE PEOPLE'S REPUBLIC)



THE CHINESE PEOPLE'S AIR FORCE

COLOMBIA



THE COLOMBIAN AIR FORCE

CUBA



THE CUBAN AIR CORPS

CZECHOSLOVAKIA



THE CZECHOSLOVAK AIR FORCE

DENMARK



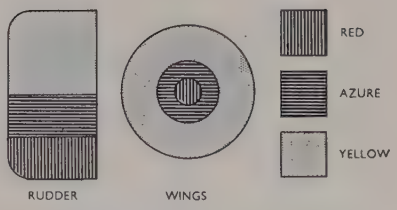
THE ROYAL DANISH AIR FORCE

DOMINICAN REPUBLIC



THE DOMINICAN AIR FORCE

ECUADOR



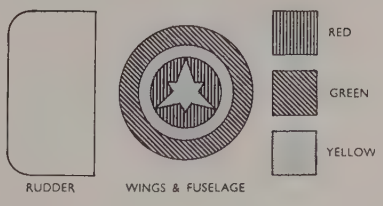
THE ECUADOREAN AIR FORCE

EGYPT



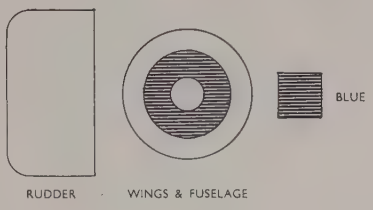
THE EGYPTIAN AIR FORCE

ETHIOPIA



THE IMPERIAL ETHIOPIAN AIR FORCE

FINLAND



THE FINNISH AIR FORCE

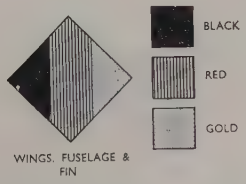
FRANCE



(Naval Aircraft have Black Anchor superimposed)

THE FRENCH AIR FORCE AND NAVAL AVIATION

GERMAN DEMOCRATIC REPUBLIC



THE GERMAN AIR FORCE

GERMAN FEDERAL REPUBLIC



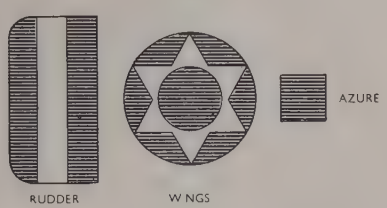
THE GERMAN AIR FORCE

GREAT BRITAIN



THE ROYAL AIR FORCE AND FLEET AIR ARM

GUATEMALA



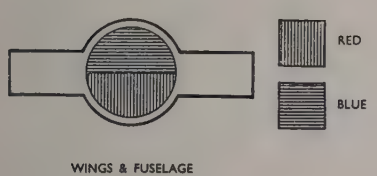
THE GUATEMALAN AIR FORCE

GREECE



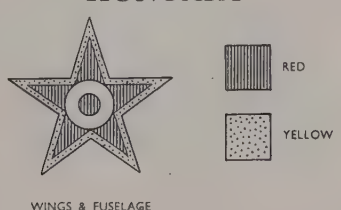
THE ROYAL HELLENIC AIR FORCE

HAITI



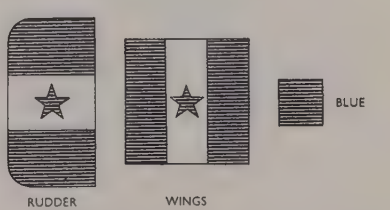
CORPS D'AVIATION D'HAITI

HUNGARY



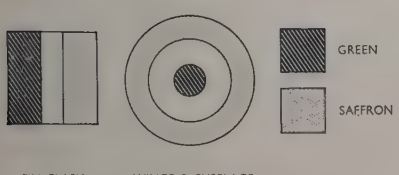
THE HUNGARIAN AIR FORCE

HONDURAS



THE HONDURAS MILITARY AIR ARM

INDIA



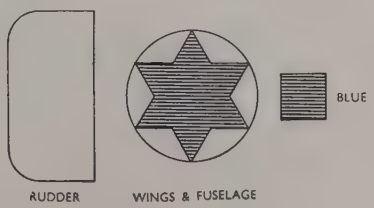
THE INDIAN AIR FORCE

INDONESIA



THE INDONESIAN AIR FORCE

ISRAEL



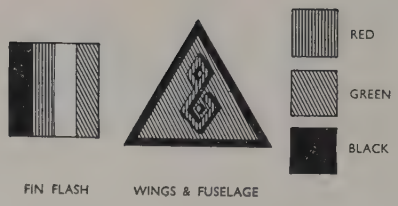
THE ISRAEL AIR FORCE

IRAN



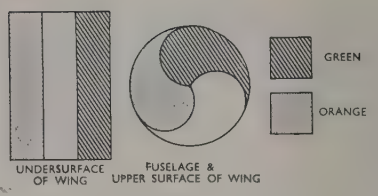
THE IMPERIAL IRANIAN AIR FORCE

IRAQ



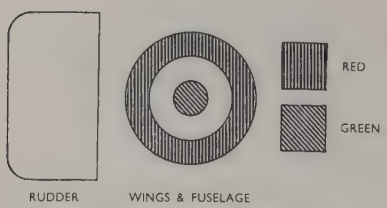
THE ROYAL IRAQI AIR FORCE

IRELAND



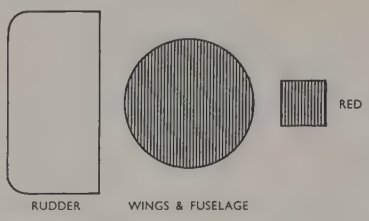
THE IRISH AIR CORPS

ITALY



THE ITALIAN AIR FORCE

JAPAN



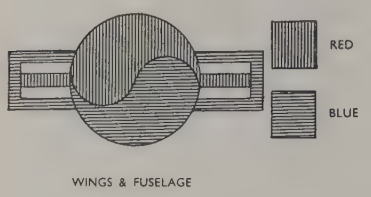
THE JAPANESE DEFENCE FORCES

JORDAN



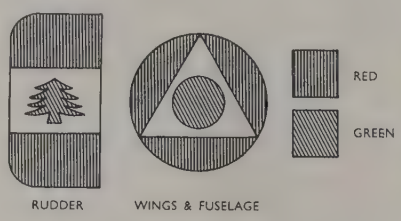
THE ROYAL JORDANIAN AIR FORCE

KOREA



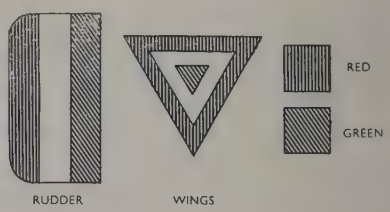
THE REPUBLIC OF KOREA AIR FORCE

LEBANON



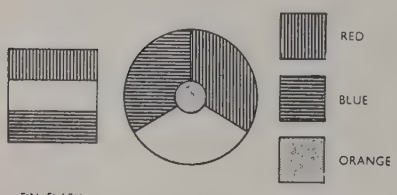
THE LEBANESE AIR FORCE

MEXICO



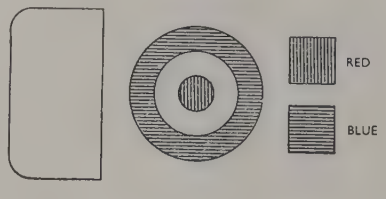
THE MEXICAN AIR FORCE

NETHERLANDS



THE ROYAL NETHERLANDS AIR FORCE

NEW ZEALAND



THE ROYAL NEW ZEALAND AIR FORCE

NICARAGUA



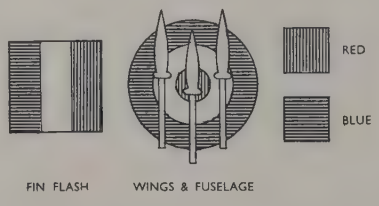
THE NICARAGUAN ARMY AIR FORCE

NORWAY



THE ROYAL NORWEGIAN AIR FORCE

RHODESIA & NYASALAND



THE ROYAL RHODESIAN AIR FORCE

PAKISTAN



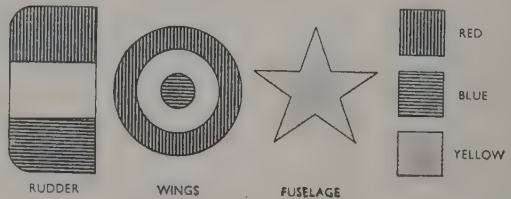
THE PAKISTAN AIR FORCE

PERU



THE PERUVIAN AIR FORCE

PARAGUAY



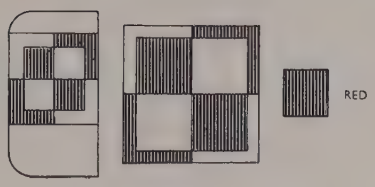
THE PARAGUAYAN AIR FORCE

PHILIPPINE REPUBLIC



THE PHILIPPINE AIR FORCE

POLAND



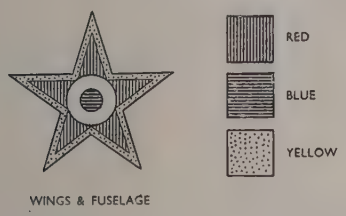
THE POLISH AIR FORCE

PORTUGAL



THE PORTUGUESE AIR ARM

RUMANIA



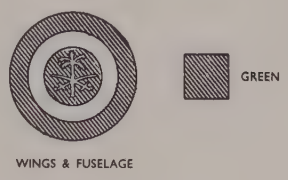
THE RUMANIAN AIR FORCE

SALVADOR



THE MILITARY AIR ARM

SAUDI ARABIA



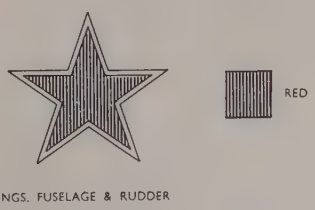
THE SAUDI ARABIAN AIR FORCE

SOUTH AFRICA



THE SOUTH AFRICAN AIR FORCE

SOVIET UNION



THE RUSSIAN AIR FORCE

SPAIN



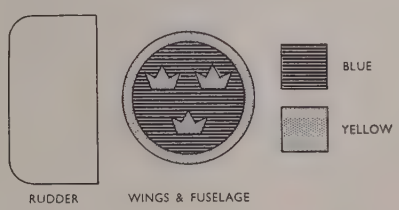
THE SPANISH AIR FORCE

SUDAN



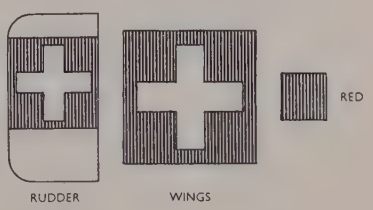
THE SUDAN AIR FORCE

SWEDEN



THE ROYAL SWEDISH AIR FORCE

SWITZERLAND



THE SWISS AIR FORCE

SYRIA



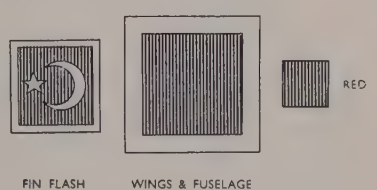
THE SYRIAN AIR FORCE

THAILAND



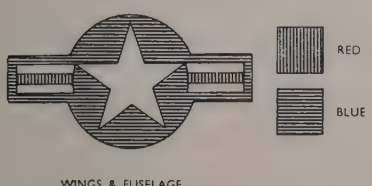
THE ROYAL THAI AIR FORCE

TURKEY



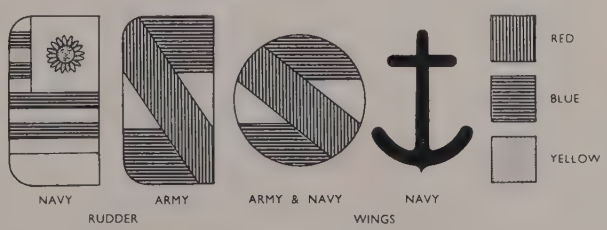
THE TURKISH AIR FORCE

UNITED STATES OF AMERICA



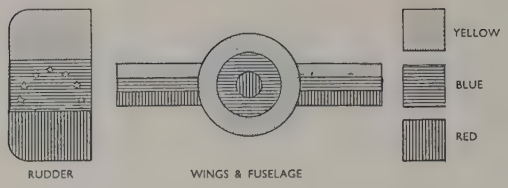
THE UNITED STATES AIR FORCE AND ARMY AND NAVAL AVIATION

URUGUAY



URUGUAYAN MILITARY AND NAVAL AVIATION

VENEZUELA



THE VENEZUELAN AIR FORCES

VIET-NAM



THE VIET-NAMESE AIR FORCE

YUGOSLAVIA



THE YUGOSLAV AIR FORCE

THE WORLD'S CIVIL AVIATION

ARRANGED IN

ALPHABETICAL ORDER OF NATIONS

INCLUDING DETAILS OF THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO), THE INTERNATIONAL AIR TRANSPORT ORGANIZATION (IATA), THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (FAI), AND OF THE AIRLINES OF THE WORLD

INTERNATIONAL CIVIL AIRCRAFT MARKINGS

AN- Nicaragua.
AP- Pakistan.
B- Taiwan (Nationalist China)
CB- and **CP-** Bolivia.
CC- Chile.
CCCP- Soviet Union (U.S.S.R.)
CF- Canada.
CR- and **CS-** Portugal and Colonies.
CU- Cuba.
CX- Uruguay.
D- Western Germany.
DM- Eastern Germany.
EC- Spain.
EI- and **EJ-** Ireland.
EL- Liberia.
EP- Iran.
ET- Ethiopia.
F- France and the French Union.
G- United Kingdom.
HA- Hungary.
HB- Switzerland.
HC- Ecuador.
HH- Haiti.
HI- Dominican Republic.
HK- Colombia.
HL- Republic of Korea
HP- Republic of Panama.
HS- Thailand.
HZ- Saudi Arabia
I- Italy.
JA- Japan.
JY- Jordan.
JZ- Netherlands New Guinea.
LN- Norway.
LQ- and **LV-** Argentine Republic.
LX- Luxembourg.
LZ- Bulgaria.
MC- Monte Carlo.
MR- Principality of Monaco.
N United States of America.
OB- Peru.
OD- Lebanon.
OE- Austria.
OH- Finland.
OK- Czechoslovakia.
OO- Belgium.
OY- Denmark.
PH- Netherlands.
PI- Philippine Republic.
PJ- Netherlands Antilles.
PK- Indonesia.
PP- and **PT-** Brazil.
PZ- Netherlands Guiana.
SE- Sweden.
SN- Sudan.
SP- Poland.
SU- Egypt.
SX- Greece.
TC- Turkey.
TF- Iceland.
TG- Guatemala.
TI- Costa Rica.
VH- Australia.
VP-A Ghana.
VP-B Bahamas.
VP-F Falkland Islands.
VP-G British Guiana.
VP-H British Honduras.
VP-J Jamaica.
VP-K Kenya.
VP-L Leeward Islands.
VP-M Malta.
VP-N Nyasaland
VP-P Islands under the rule of the Western Pacific High Commission.
VP-R N. Rhodesia
VP-S British Somaliland.
VP-T Trinidad and Tobago.
VP-U Uganda.
VP-V St. Vincent.
VP-X Gambia.
VP-Y S. Rhodesia
VP-Z Zanzibar.
VQ-B Barbados.
VQ-C Cyprus.
VQ-F Fiji Islands.
VQ-G Grenada.
VQ-H St. Helena.
VQ-L St. Lucia.
VQ-M Mauritius.
VQ-S Seychelle Islands.
VR-A Aden.
VR-B Bermuda.
VR-G Gibraltar.
VR-H Hong Kong.
VR-L Sierra Leone.
VR-N Nigeria.
VR-O British North Borneo.
VR-R Malaya.
VR-S Singapore
VR-T Tanganyika.
VR-U Brunei.
VR-W Sarawak.
VT- India.
XA-, XB- and **XC-** Mexico.
XH- Honduras.
XT- Republic of China.
XY- and **XZ-** Burma.
YA- Afghanistan.
YE- Yemen.
YI- Iraq.
YK- Syria.
YR- Rumania.
YS- El Salvador.
YU- Yugoslavia.
YV- Venezuela.
ZA- Albania.
ZK-, ZL- and **ZM-** New Zealand.
ZP- Paraguay.
ZS-, ZT- and **ZU-** Union of South Africa.
3W- Viet-nam.
4R- Ceylon.
4X- Israel.
5A- Libya.

INTERNATIONAL ORGANIZATIONS

THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (I.C.A.O.)

HEADQUARTERS: International Aviation Building, Montreal, Canada.

THE COUNCIL

President: Ing. Walter Binaghi.

Member of the Council for the United Kingdom: J. H. Riddoch.

Secretary General: E. C. R. Ljungberg.

Assistant Secretary General for Air Navigation: A. Ferrier.

Assistant Secretary General for Air Transport: E. M. Weld.

Director, Bureau of Administration and Services: J. F. Berrier.

Director, Legal Bureau: P. K. Roy.

Director, Technical Assistance Bureau: E. R. Marlin.

Chief, Public Information: L. C. Boussard.

Member States (as at May 1, 1956): Afghanistan, *Argentina, *Australia, Austria, *Belgium, Bolivia, *Brazil, Burma, Cambodia, *Canada, Ceylon, Chile, China, Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, Federal Republic of Germany, Ecuador, *Egypt, El Salvador, Ethiopia, Finland, *France, Ghana, Greece, Guatemala, Haiti, Honduras, Iceland, *India, Indonesia, Iran, Iraq, *Ireland, Israel, *Italy, *Japan, Jordan, Korea, Laos, *Lebanon, Liberia, Libya, Luxembourg, *Mexico, Morocco, *Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Paraguay, Peru, Philippines, Poland, *Portugal, *Spain, Sudan, *Sweden, Switzerland, Syria, Thailand, Turkey, *Union of South Africa, *United Kingdom, *United States, Uruguay, *Venezuela, Viet-Nam.
(*denotes Member of Council).

The International Civil Aviation Organization, successor to the Provisional International Civil Aviation Organization (P.I.C.A.O.), came into being on April 4, 1947, following the ratification of the Permanent Convention by the required number of States.

The Organization is governed by an Assembly and a Council.

The Assembly

Is convened by the Council. Extraordinary meetings of the Assembly may be held at any time when called by the Council or at the request of any ten member States. All member States have equal right to be represented at the meetings of the Assembly and each member is entitled to one vote. The powers and duties of the Assembly are: (*a*) to elect at each meeting its president and officers; (*b*) to elect the member States to be represented on the Council; (*c*) to examine and take action upon the reports of the Council; (*d*) to determine its own rules of procedure and establish such subsidiary commissions and committees as are needed; approve an annual budget and determine the financial arrangements of the Organization; (*e*) to refer any specific matters to the Council; (*f*) to delegate the necessary powers and authority to the Council which are needed for the duties of the organization; and (*g*) to deal with any matters not specifically assigned to the Council.

The Council

The Council is composed of 21 member States elected by the Assembly for a period of three years, adequate representation being given to: (1) those member States of chief importance in air transport; (2) those member States not otherwise included which make the largest contribution to the provision of facilities for international civil air navigation; (3) those member States not otherwise included whose election will ensure that all major geographical areas of the World are represented. No representative of a member State on the Council may be actively associated with or financially interested in the operation of an international air service.

The Council elects a President, who has no vote. One or more vice-presidents are elected from among the members, and retain the right to vote when serving as acting president. Decisions of the Council are deemed valid when approved by a majority of all members. Any member State not a member of the Council may participate in deliberations whenever any decision is to be taken which especially concerns such a member State, but such a State may not vote. In any case in which there is a dispute between one or more member States not members of the Council and one or more member States who are members of the Council, any State within the second category which is party to the dispute shall have no right to vote on that dispute.

The duties and powers of the Council are:—

(1) to discharge the directives of the Assembly.

(2) to determine its own organization.

(3) to determine the method of appointment, emoluments and conditions of service of the employees of the organization.

(4) to appoint a Secretary-General.

(5) to provide for the establishment of any subsidiary working groups which may be considered desirable, including the following:—

(*a*) A Committee on Air Transport.
(*b*) A Commission on Air Navigation.

(6) to prepare and submit to the Assembly budget estimates of the Organization and statements of accounts of all reports and expenditures.

(7) to enter into agreements with other international bodies when deemed advisable for the maintenance of common service and for common arrangements concerning personnel and, with the approval of the Assembly, enter into such other arrangements as may facilitate the work of the Organization.

In addition, the functions of the Council are to maintain liaison with the member States, calling on them for such data and information as may be required; receive, register and hold open to inspection by member States, all existing contracts and agreements covering routes, services, landing rights, airport facilities, or other international air matters to which any member State or its airlines is a party; supervise and co-ordinate the works of the subsidiary bodies, consider their reports and transmit them and the findings of the Council to the member States. In addition, the Council is to make recommendations on technical matters to the member States of the Assembly, and submit an annual report to the Assembly. When requested by all the parties concerned, the Council will act as an arbitral body on any difference arising among member States relating to international civil aviation matters which may be submitted to it.

The expenses of the Organization are borne by the member States in proportions decided by the Assembly. Each member State bears the expenses of its own delegation to the Assembly and those of its delegates on the Council and its representatives on committees or subsidiary groups.

Each contracting State undertakes that its international airlines shall file traffic reports, cost statistics and financial states with the Council. Each contracting State may designate the route to be followed within its territory by any international air service, and the airports which any such service may use. If the Council is of the opinion that the airports or other navigation facilities of a contracting State are not reasonably adequate the Council may consult with the State and others affected, to find means of correcting the position and may make recommendations. If requested by the State, the Council may provide all or a portion of the costs needed for the remedies.

A contracting State may at any time discharge any obligation into which it has entered and take over airports and other facilities which the Council has established in its territory by paying to the Council an amount considered reasonable.

The Council may suggest to contracting States that they form joint organizations to operate air services on any routes or in any regions.

The duties of the subsidiary bodies established under the Council shall be:—

Air Transport. To observe, correlate and report continually on facts concerning the origin and volume of international air traffic and the relation of such traffic, or the demand for it, to the facilities provided; collect, analyse and report on subsidies, tariffs and costs of operation; study matters affecting the organization and operation of international air services, including the international ownership and operation of international trunk lines; and study and report, with recommendations, to the Assembly on matters on which agreement was not reached at the Chicago International Civil Aviation Conference.

Air Navigation. To study and advise the Council on standards and procedures for communications systems and air navigation aids including rules of the air, traffic control practices, licensing of operating and mechanical personnel, airworthiness, registration and identification of aircraft, meteorological protection of international aeronautics, log books, maps and charts, airports, customs, accident investigation and so forth. In addition it will work towards the adoption of minimum requirements and standard procedures for all the above and continue the preparation of technical documents in accordance with the recommendations of the Chicago Conference.

THE INTERNATIONAL AIR TRANSPORT ASSOCIATION (I.A.T.A.)

HEAD OFFICE: Terminal Centre Buildings, 1060, University Street, Montreal 3, P.Q., Canada.

BRANCH OFFICES: 30, Curzon Street, W.1, London (I.A.T.A. Clearing House, I.A.T.A. European-African Technical Liaison Office); 500, Fifth Avenue, New York 36 (I.A.T.A. Traffic Conference No. 1, I.A.T.A. Enforcement Office); 76-78, Champs Elysées, Paris (8e.) (I.A.T.A. Traffic Conference No. 2); MacDonald House, Singapore, Malaya. (I.A.T.A. Traffic Conference No. 3).

President (1956-57): Lord Douglas of Kirtleside (British European Airways).

President-elect (1957-58): Dr. Tomas Delgado (IBERIA Airlines of Spain).

President-elect (1958-59): J. R. D. Tata (Air India International).

Director General: Sir William P. Hildred.

Treasurer and Financial Director: Dr. H. J. Gorecki.

Traffic Director: John Brancker.

Secretary: A. Laurence Young.

Legal Adviser: Prof. John C. Cooper.

Technical Director: Stanislav Krzyczkowski.

Executive Committee: General A. I. Aler (KLM); Dr. Walter Berchtold (Swissair); René Briend (Air France); Colonel Luis A. Calderon, (LAV); Lord Douglas of Kirtleside (British European Airways); Sir Wilmot Hudson Fysh (Qantas Empire Airways); Croil Hunter (Northwest Airlines); John C. Leslie (Pan American World Airways); Major J. Ronald McCrindle (B.O.A.C.); Gordon R. McGregor (Trans-Canada Airlines); Per A. Norlin (S.A.S.); Gregorio Obregon P. (Aerovias Nacionales de Colombia); Gilbert Périer (SABENA); Warren Lee Pierson (Trans World Airlines); D. M. Robertze (SAA); J. R. D. Tata (Air India International); Seijiro Yanagita (Japan Air Lines); Sheikh Nagib Alamuddin (Middle East Airlines); Rubem Berta (VARIG).

Financial Committee: A. V. Leslie (TWA), Chairman; Dr. H. J. Gorecki, Secretary.

Legal Committee: W. A. Steenstra Toussaint (KLM), Chairman; J. G. Gazdik, Secretary.

Medical Committee: Sir Harold Whittingham (B.O.A.C.), Chairman; A. M. Black, Secretary.

Technical Committee: A. V. J. Vernieuwe (SABENA), Chairman: Stanislaw Krzyczkowski, Secretary.

Traffic Advisory Committee: G. M. Bain (Northwest Airlines), Chairman.

Chief Enforcement Officer: R. Feick.

Economics and Statistics Officer: Harold E. Shenton.

Legal Drafting Officer: W. M. Sheehan.

Public Relations Officer: S. Ralph Cohen.

Facilitation Officer: C. W. R. Vallance.

Manager of London Clearing House: A. J. Quin-Harkin.

European Technical Liaison Officer: J. L. Gilmore.

Traffic Conference Secretaries: V. de Boursac (Paris); E. S. Pefanis (New York); R. A. McGowan (Singapore).

The International Air Transport Association was formally inaugurated on April 19, 1945, at Havana, following a conference of international airline operators. Invitations to the conference and plans for the new organization were drawn up at a conference held in Chicago in December, 1944, on the initiative of the American Air Transport Association and attended by 34 representatives of 21 nations. The new Association succeeds the original International Air Traffic Association founded in 1919.

Headquarters of I.A.T.A. are at Montreal, Canada, and the association consists of a General Assembly and an Executive Committee, in which is vested the management of the association. The post of President is honorary.

The aims and objects of I.A.T.A. are to promote safe, regular and economical air transport; to foster the development of air commerce, and to study all problems connected therewith; to provide efficient machinery for collaboration among all air transport operators who are engaged directly or indirectly in international air transport service; and to co-operate with the International Civil Aviation Organization (I.C.A.O.) and other international bodies.

There are two categories of membership—Active and Associate. Any air transport enterprise is eligible for active membership if it operates a scheduled air service under proper authority for the carriage of passengers, mail or cargo, between the territories of two or more States, under the flag of a State eligible to membership in the International Civil Aviation Organisation.

The Active Members at June 1, 1957 were :—*Aer Lingus Teoranta (Dublin); Aerolineas Argentinas (Buenos Aires); Alitalia-Linee Aeree Italiane (Rome); Aero O/Y (FINNAIR) (Helsinki); *Aerovias Nacionales de Colombia (AVIANCA) (Bogota); *Air Algérie (Algiers); *Air Ceylon Ltd. (Colombo); *Air France (Paris); *Air India International (Bombay); Air Liban (Beirut); *Air Vietnam (Saigon); *American Airlines Inc. (New York); *Aviacion y Comercio, S.A. (Madrid); †Braniff Airways Inc. (Dallas); *British European Airways (London); *British Overseas Airways Corporation (London); *Canadian Pacific Air Lines, Ltd. (Vancouver); *Central African Airways Corporation (Salisbury, Southern Rhodesia); *Ceskoslovenske Aerolinie, N.P. (Prague); Civil Air Transport (Taipei); †Compania Cubana de Aviacion (CUBANA) (Havana); *Compagnie de Transports Aériens Intercontinentaux (TAI) (Paris); *Cyprus Airways Ltd. (Nicosia); †Delta-C & S. Air Lines Inc. (Atlanta); *Deutsche Lufthansa (Cologne); Divisão de Exploração dos Transportes Aereos (DETA) (Lourenço Marques); Divisão de Exploração dos Transportes Aereos (DTA) (Luanda); East African Airways Corporation (Nairobi); †Eastern Airlines (New York); El Al, Israel Airlines Ltd. (Tel Aviv); *Empresa de Viação Aerea Rio Grandense (VARIG) (Porto Alegre); *Flugfelag Islands (Icelandair) (Reykjavik); *Garuda Indonesian Airways N.V. (Djakarta); *Guest Aerovias Mexico, S.A. (Mexico City); *Hunting-Clan Air Transport Ltd. (London); IBERIA (Airlines of Spain) (Madrid); *Iraqi Airways (Baghdad); *Japan Air Lines Company, Ltd. (Tokyo); *Jugoslovenski Aerotransport (JAT) (Belgrade); *KLM Royal Dutch Airlines (The Hague); Linea Aerea Nacional (LAN) (Santiago, Chile); *Linea Aeropostal Venezolana (Caracas); *Malayan Airways Ltd. (Singapore); *Middle East Airlines (Beirut); Misrair, S.A.E. (Cairo); †National Airlines Inc. (Miami); *Olympic Airways (Athens); *Northwest Airlines Inc. (St. Paul); *Pakistan International Airlines (Karachi); *Panair do Brasil, S.A. (Rio de Janeiro); *Pan-American Grace Airways Inc. (New York); *Pan-American World Airways Inc. (New York); *Philippine Air Lines Inc. (Manila); Polish State Airlines (LOT) (Warsaw); *Qantas Empire Airways, Ltd. (Sydney); *Scandinavian Airlines System (Stockholm); Seaboard and Western Airlines, Inc. (New York); Services Aereos Cruzeiro do Sul, Ltda. (Rio de Janeiro); *Société Anonyme Belge d'Exploitation de la Navigation Aerienne (SABENA) (Brussels); *South African Airways (Johannesburg); *Swiss Air Transport Co. Ltd. (Zurich); *Tasman Empire Airways Ltd. (Auckland); *Trans Canada Air Lines (Montreal); Transportes Aereos Portugueses (TAP) (Lisbon); *Trans World Airlines, Inc. (New York); Turk Hava Yolari (Turkish Airlines) (Ankara); *Union Aéromaritime de Transport (UAT) (Paris); †United Air Lines (Chicago); *West African Airways Corporation (Lagos).

(* Member of I.A.T.A. Clearing House).

(† Clears via Airlines Clearing House).

Associate membership may be obtained by any air transport concern operating an authorised scheduled air service under the flag of a State eligible for membership in the International Civil Aviation Organization. The Associate Member companies are :—*Airwork Ltd. (London); *Australian National Airways Pty. (Melbourne); †Chicago Helicopter Airways, Inc. (Chicago); †New York Airways Inc. (New York); *New Zealand National Airways (Wellington); *Trans-Australia Airlines (Melbourne).

The creative work of I.A.T.A. is done largely by five Standing Committees—Financial, Legal, Medical, Technical and Traffic Advisory. Their affairs are administered by I.A.T.A.'s small secretariat who provide services for them and carry forward their recommendations. Rules for the conduct of the committees are laid down, and their decisions subject to final approval by the Executive Committee.

The Financial Committee has in its purview all financial matters connected with air transport; standardization of methods of rendering; verifying and settling accounts for revenue transactions between members; aeronautical insurance matters; introduction and control of money documents; and statistical matters. An important step was the creation of the I.A.T.A. Clearing House, whose operations provide for the airlines an approach to an international currency. Set up to handle the inter-company revenue transactions of I.A.T.A. members, the Clearing House offsets their balances on a monthly basis and consolidates the result into a single monthly statement to each. Besides eliminating exchange risks and the costs involved in the ordinary settlement of these accounts the Clearing House makes it possible for its members to do business in both sterling and dollars.

An agreement was reached in May, 1948, for inter-clearance between I.A.T.A. and the Airlines Clearing House, Chicago. This arrangement between the two clearing houses enables the North American operators to accept bookings from soft currency areas, as well as from those countries which can pay in dollars, and to exchange business under the terms of the Universal Air Travel Plan.

The Legal Committee deals generally with legal matters having a bearing on international air transport, particularly with international conventions on public and private air law and on other means of transport; with conflicts of law and with arbitration.

The Medical Committee has within its purview the physiological and psychological aspects of flight as they affect passengers and aircrew; international sanitary regulations, etc.

The Technical Committee concerns itself with all international operational and engineering matters; promotion of safety and efficiency in flight; standardization of equipment and consumable spares; unification of procedures; radio and electronics; meteorology; maintenance of aircraft; airways and ground aids. Once a year, the personnel of the Technical Committee and its various working groups hold a Technical Conference, in which the airlines of the world exchange technical information and recommend technical policy on an international basis. Government agencies, manufacturers, research establishments and other international organizations also participate in these Conferences,

I.A.T.A.'s technical branch has achieved a large measure of unification of operating practices as between the airlines themselves. An exchange of vital information about the causes of accidents and near accidents, as well as about other practical matters, is fruitfully carried on. I.A.T.A. technical delegations have also played a part in working out the allocation of frequencies for communications purposes voted by the International Telecommunications Union Conference, and have co-operated also with the International Meteorological Organization and others.

Under the heading of Traffic, I.A.T.A. is concerned with all matters involving passengers, cargo and the handling of mail. It continually studies tariffs and schedules; general conditions of carriage; all matters pertaining to agents; and the forms, documents and procedures used by the airlines themselves or required of them and their customers by governments. Traffic work is co-ordinated by the Traffic Director and the Traffic

Advisory Committee and the Association's studies represent the best opinion of the whole industry, arrived at from the point of view of the worldwide air transport network.

Applying many of these recommendations to day-to-day operations over the whole world and under highly variable conditions, is a complicated and delicate task. The final recommendations on rates and tariffs, conditions of carriage and agency matters are therefore left to Conferences, made up of the companies concerned actually providing service in any of the three following regions: I—North and South America, Greenland and the Hawaiian Islands; II—Europe, Africa and the Middle East, including Iran; and III—Asia, Australasia and the islands of the Pacific.

Within their terms of reference, the Traffic Conferences are autonomous. Their resolutions must be passed unanimously, and because of the high degree of public interest involved, they are subject to the approval of a number of governments.

This public concern applies particularly to the matters of rates and fares; many governments have, by international agreement or national law, recognized the Conferences as agencies by which their various economic interests in international air transport can be fairly adjusted.

In traffic procedures and practices, the I.A.T.A. Traffic Conferences have achieved a degree of worldwide uniformity unprecedented in the history of transport. Since the first worldwide joint Traffic Conference meetings at Rio de Janeiro, in October, 1947, I.A.T.A. has achieved the adoption of worldwide uniform tickets, air waybills, consignment notes and other documents; flight-line numbers and airline designators; conditions of contract and agency agreements and resolutions; as well as the development of a worldwide rate structure. Most recent achievements include the extension of the interline agreements and the services of more than 100 carriers throughout the World; the adoption of the first uniform Worldwide conditions of carriage in the history of transportation; and of a uniform restricted articles code applicable on a Worldwide basis to cargo. The three Conferences now meet in Composite session.

A basic part of the work of I.A.T.A. is daily co-operation with I.C.A.O. in the drafting of the latter organization's Standards and Recommended Practices, which set an international pattern for national technical regulation of aviation. Experts of I.A.T.A. member airlines and members of the I.A.T.A. Secretariat participate in all regional and divisional meetings of I.C.A.O., making available to the government organization the practical operating knowledge of the airlines. This technical work has been both intensive and extensive, covering all phases of technical operations and concerning itself with a multitude of details.

I.A.T.A. maintains close contact with I.C.A.O. in many other fields. Both organizations are vitally concerned in the campaign to facilitate international commerce by air, and I.A.T.A. has formed regional committees of airline operators to encourage government adoption of the I.C.A.O. Facilitation Standards.

Other organizations with whom I.A.T.A. maintains close working liaison include the Universal Postal Union, International Telecommunications Union, and other organizations in the fields in which air transport is interested.

I.A.T.A. has been commissioned by its members to issue certain publications on their behalf. Among these, the following are available to the interested public and may be ordered from the Head Office at Montreal:—

I.A.T.A. Bulletin. Published yearly in English, French and Spanish editions as the official record of the proceedings of the Association. $2.00 (U.S.) per copy.

Tabulation of Great Circle Distances. $5.00 (U.S.) per year, including 12 months' revision service.

Universal Interline Reservations Code. Given publication through various air guides.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F.A.I.)

HEAD OFFICE: 6, RUE GALILÉE, PARIS, FRANCE.

President: General C. Sillevaerts (Belgium).

Honorary Presidents: Mr. Godfrey L. Cabot, L.L.D. (U.S.A.); Lord Brabazon of Tara, M.C., P.C. (Great Britain); Mr. William R. Enyart (U.S.A.); Mr. M. C. Kolff (Netherlands); Captain K. J. G. Bartlett (Great Britain).

First Vice-President: Miss Jacqueline Cochran.

Director General: Mr. H. R. Gillman, O.B.E. (Great Britain).

Treasurer General: M. Jean Blériot.

Vice-Presidents: Dr. Josef Gaisbacher (Austria); Capt. J. Foltmann (Denmark); Jacques Allez (France); Carl Francke (Germany); Capt. K. J. G. Bartlett (Great Britain); C. Kolff (Netherlands); General Napoleone Del Duca (Italy); José Villaneuva (Mexico); José Maria Marcet y Coll (Spain); Major-General Nils Söderberg (Sweden); Mustafa Zeren (Turkey); S. Staritchevski (U.S.S.R.); Slobadan Sakota (Yugoslavia).

The *Fédération Aéronautique Internationale* was founded in Paris, in October, 1905. The countries represented at its foundation were Belgium, France, Germany, Great Britain, Italy, Spain, Switzerland, and the United States of America. The aim was co-operation between nations concerning aeronautics and with the development of aviation the F.A.I. has become the international representative body of world private aviation. The first record to be officially homologated by the F.A.I. was a speed record of 41.29 km.h. (25.06 m.p.h.) set up on November 12, 1906 by Alberto Santos Dumont. He was timed over a distance of 220 metres (721 feet), which was as far as he could then fly.

Before and between the two wars many international arrangements were made under the supervision of the F.A.I. and international rules and sports codes for private flying were drawn up. Most of the countries which were represented on the F.A.I. through their accredited national Aero Clubs have agreed to recognise the *Carnet de passages en Douane* making private flying between countries easier. Landing facilities and international sport and touring licences were introduced. The F.A.I. also played an important *rôle* in the development of gliding, soaring and model aircraft flying.

All World or National Records must be observed by a representative of a national Aero Club affiliated to the F.A.I. before such a record is homologated or approved by the F.A.I.

The F.A.I., through its *Commission Internationale de l'Aviation Legère et du Tourisme Aérien* (C.I.A.L.T.A.) maintains the closest co-operation with I.C.A.O. through a liaison officer in Montreal.

The F.A.I. sits annually in general conference, but its various commissions sit more often.

The following is the list of national Aero Clubs, Federations or Associations which are affiliated to the F.A.I. (correct at June 1st, 1956):—

Argentina. Aero-Club Argentino, Rodriguez Pena 240, Buenos Aires.

Australia. The Aero Club Federation of Australia, 108 Queen Street, Melbourne.

Austria. Oesterreichischer Aero-Club, Salesianergasse 1, Vienna III.

Belgium. Aero-Club Royal de Belgique, 53 Avenue des Arts, Brussels.

Brazil. Aero-Club do Brasil, Av. Brasil s/n Manguinhos, Rio de Janeiro.

Bulgaria. Aéro-Club Central de la Republique Populaire de Bulgarie, Rue Cristo Botev, 48, Sofia.

Canada. The Royal Canadian Flying Clubs Association, 77, Metcalfe Street, Ottawa.

Chile. Federacion Aerea de Chile, Huérfanos 1147, Officina 642, Santiago du Chile.

Colombia. Aero-Club de Colombia, Edificio Narino, Avenida Jimenez de Quesada 11-28, Bogota.

Cuba. Club de Aviacion de Cuba, Edificio Larrea 206, Aguiar y empedrado, Havana.

Czechoslovakia. Aeroklub Republiky Ceskoslovenské, Opeletalova 29, Prague.

Denmark. Kongelig Dansk Aeroklub, Osterbrogade 40, Copenhagen.

Ecuador. Aero-Club del Ecuador, Casilla 348, Guayaquil.

Egypt. Aéro-Club d'Egypte, 26 rue Cherif Pacha, Cairo.

Finland. Suomen Ilmailuliitto, Mannerheimintie 16, Helsinki.

France. Aéro-Club de France, 6 rue Galilée, Paris.

German Federal Republic. Deutscher Aero-Club e V., Bockenheimer Landstr, 19/II, Frankfurt-am-Main.

Great Britain. The Royal Aero Club of the United Kingdom, 119 Piccadilly, London, W.1.

Greece. Royal Aero Club of Greece, 35 Jan Smuts Street, Athens.

Hungary. Magyar Nepkoztarsasag "Fehervari Miklos" Kozponti Repulo Klubja, Engelster 14, Budapest V.

Iceland. Flugmalafelag Islands, Reykjavik Airport, Reykjavik.

India. Aero Club of India, United India Life Building, Connaught Place, New Delhi 1.

Ireland. Irish Aviation Club, Dublin Airport, Dublin.

Israel. The Aero Club of Israel, 9 Montefiore Street, P.O.B. 1311, Tel Aviv.

Italy. Aero-Club d'Italia, via Cesare Beccaria 35, Rome.

Japan. Nippon Koku Kyokai, Hikokan (Aviation) Building, 1-3 Tamura-Cho, Minato-Ku, Yokyo.

Luxemburg. Aéro-Club du Grand-Duché de Luxembourg, Boite Portale 212, Luxembourg-Ville.

Mexico. Club Aereo de Mexico, Aeropuerto Central, Mexico D.F.

Monaco. Aero-Club de Monaco, 8 rue Grimaldi, Monaco.

Netherlands. Koninklijke Nederlandse Vereniging Voor Luchtvaart, Josef Israelsplein 8, The Hague.

New Zealand. Royal New Zealand Aero Club, 39 Johnston Street, Wellington C.

Norway. Norsk Aero-Klubb, ovre Vollgate 7, Oslo.

Peru. Aero-Club del Peru, Baquijano 722, Lima.

Poland. Aeroklub Rzeczypospolitej Polskiej, Ul Dluga 52, Warsaw.

Portugal. Aéro-Club de Portugal, Avenida da Liberdade 226, Lisbon.

South Africa. The Aero Club of South Africa, P.O. Box 2312, Johannesburg.

Soviet Union. Aero-Club Central de l'U.S.S.R., V.P. Tchkalov, Moscow—Touchino.

Spain. Real Aero-Club de Espana, Carrera de San Jeronimo 19, Madrid.

Sweden. Kungl. Svenska Aeroklubben, Malmskillnadsgaten 27, Stockholm.

Switzerland. Aero-Club de Suisse, Hirschengraben 22, Zurich.

Turkey. Turk Hava Kurumu, Enstitü Caddesi 1, Ankara.

United States. National Aeronautic Association of U.S.A., 1025 Connecticut Avenue, Washington D.C.

Uruguay. Aero-Club del Uruguay, Paysandu 896, Montevideo.

Venezuela. Federacion Venezolana de Aeronautica, Apartado 336, Edificio Ayacucho, Conde a Padre Sierra, Caracas.

Yugoslavia. Vazduhoplovni Savez Jugoslavije, Uzun Mirkova 4/1, Belgrade.

WORLD'S RECORDS

Homologated by the Fédération Aéronautique Internationale.

ABSOLUTE RECORDS IRRESPECTIVE OF CLASS

Distance in Straight Line (U.S.A.).
Cdr. T. D. Davies, Cdr. E. P. Rankin, Cdr. S. Reid, Lieut-Cdr. R. A. Tabeling, U.S.N. in a Lockheed P2V-1. Perth Australia, to Columbus, Ohio, U.S.A. September 29-October 1, 1946. 18,081.99 km. (11,235.6 miles).

Distance in Closed Circuit (U.S.A.).
Lieut. Col. Lassiter and Capt. W. J. Valentine, U.S.A.F. in a Boeing B-29. August 1-3, 1947. 14,249.656 km. (8,854 miles).

Altitude (U.S.A.).
Capt. A. O. Anderson and Capt. A. W. Stevens in the balloon "Explorer II." November 11, 1935. 22,066 m. (72,395 ft.).

Speed (Great Britain).
L. P. Twiss in the Fairey Delta 2 (Rolls-Royce Avon with afterburner). Ford-Chichester. March 10, 1956. 1,822 km.h. (1131.46 m.p.h.).

Speed in Closed Circuit (U.S.A.).
R. O. Rahn in a Douglas XF4D-1 (Westinghouse J40 engine). Edwards AFB, California. October 16, 1953. 1,171.788 km.h. (727.67 m.p.h.).

RECORDS BY CLASS

The following Classes are recognised by the F.A.I. for record purposes :—Class A (Spherical Balloons) ; Class B (Dirigibles); Class C (Powered Aircraft) ; Class D (Motorless Aircraft) ; and Class E (Rotary-wing Aircraft). Listed below are the principal records for Speed, Altitude and Distance in Classes C, D and E. Classes A and B, for which no records have been claimed recently, are not included.

CLASS C (POWERED AIRCRAFT).

Group 1 (*Aircraft powered by gas turbines*).

Speed (Great Britain).
L. P. Twiss in the Fairey Delta 2 (Rolls-Royce Avon and afterburner). Ford-Chichester. March 10, 1956. 1,822 km.h. (1131.46 m.p.h.).

Altitude (Great Britain).
W. F. Gibb in an English Electric Canberra (two Bristol Olympus engines). Filton, Bristol. August 29, 1955. 20,083 m. (65,872 ft.).

Distance in Straight Line (France).
Mlle. E. Boselli in a Sud-Est Mistral (Hispano-Suiza Nene engine). March 1, 1955. Creil-Agadir. 2,331.22 km. (1447.6 miles).

Distance in Closed Circuit (France).
Mlle. E. Boselli in a Sud-Est Mistral (Hispano-Suiza Nene engine). Mont de Marsan-Oran-Mont de Marsan. February 21, 1955. 1,839.7 km.h. (1142.45 m.p.h.).

Group 2 (*Aircraft powered by piston engines*).

Speed (Germany).
Fritz Wendel in a Messerschmitt Bf 109R (Daimler-Benz engine). Augsberg. April 26, 1939. 755.138 km.h. (469.2 m.p.h.).

Altitude (Italy).
Mario Pezzi in a Caproni Ca. 161*bis* (Piaggio XIR.C engine). Montecelio. October 22, 1938. 17,083 m. (56,046 ft.).

Distance in Straight Line (U.S.A.).
As Absolute Record.

Distance in Closed Circuit (U.S.A.).
As Absolute Record.

CLASS C*bis* (SEAPLANES.)

Speed (Italy).
Francesco Agello in a Macchi M.C. 72 seaplane. Descenzano. October 23, 1934. 709.209 km.h. (440.68 m.p.h.).

Altitude (Italy).
Lieut. Col. N. di Mauro in a Caproni 161*bis* seaplane. Vigna di Valle. September 25, 1939. 13,542 m. (44,429 ft.).

Distance in Straight Line (Great Britain).
Capt. D. C. T. Bennett and 1st Officer I. Hervey in Short-Mayo "Mercury" seaplane (composite launch). Dundee, Scotland, to Port Nolloth, South Africa. October 6-8, 1938. 9,652 km. (5,997.5 miles).

CLASS D (MOTORLESS AIRCRAFT).

1—*Single-seat sailplanes.*

Duration (France).
Charles Atger in an Arsenal Air-100. Romanin les Alpilles. April 2-4, 1952. 56 hours, 15 minutes.

Distance in Straight Line (U.S.A.).
Richard H. Johnson in a Ross-Johnson. From Odessa, Texas, to Salina, Kansas. August 5, 1951. 861.272 km. (535.19 miles).

Absolute Height (U.S.A.).
W. S. Ivans, Jr. in a Schweizer SGS 1-23. Bishop, California. December 30, 1950. 12,832 m. (42,099.6 ft.).

2—*Multi-seat sailplanes.*

Duration (France).
Dauvin and Couston in a Castel-Mauboussin C.M.7. Romanin les Alpilles, April 6-8, 1954. 57 hours, 10 minutes.

Distance in a Straight Line (U.S.S.R.).
Victor Iltchenko and G. Petchnikov in an A.10 sailplane from Kountsevo to Hovlia, May 26, 1953. 829.822 km. (515.626 miles).

Absolute Height (U.S.A.).
Lawrence E. Edgar and Harold E. Klieforth in Pratt-Read G.1. Bishop, Cal. March 19, 1952. 13,489 m. (44,255 ft.).

CLASS E (ROTARY-WING AIRCRAFT).

Distance in Straight Line (U.S.A.).
Elton J. Smith in a Bell 47D1. Fort Worth, Texas, to Niagara Falls, N.Y. September 17, 1952. 1,958.796 km. (1,217.1 miles).

Altitude (France).
Jean Boulet in a Sud-Est S.E.3130 Alouette, at Buc, near Paris, June 6, 1955. 8,209 m. (26,932 ft.).

Speed (U.S.A.).
Major R. L. Anderson in a Sikorsky HR25-1. Windsor Locks, Connecticut. November 11, 1956. 261.91 km.h. (162.64 m.p.h.).

THE AIRLINES OF THE WORLD

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
ADEN								
Aden Airways Ltd.	Khormaksar, Aden Colony Gen. Manager: H. C. Alger Comm. Manager: L. V. Bennett	8 Douglas DC-3 2 D.H. Rapide	10,013	1,194,233 *235,459*	26,235 *4,372*	178,165 —	3,657,827 *611,994*	A wholly-owned subsidiary of Associated British Airlines (Middle East) Ltd., Stratton House, Stratton Street, London, W.1.
AFGHANISTAN								
Aryana Airlines Company Ltd.	P.O. Box 76, Kabul President: Faiz Mohamed Ahmedzai Exec. Vice President: R. J. Forhan	3 Douglas DC-3 *On order* 2 Douglas DC-4	11,160	789,280 (including non-scheduled)	10,094	—	908,376 (including non-scheduled)	—
ALASKA								
Alaska Airlines, Inc.	2320 Sixth Avenue, Seattle 1, Washington President: Nelson David	3 Douglas DC-4 3 Douglas DC-3 3 Curtiss C-46 Commando 14 single-engine aircraft *On order:* 2 Douglas DC-6	4,810	2,431,456 *1,059,628*	44,180 *17,999*	2,574,000	7,012,000 *18,710,000*	—
Alaska Coastal Airlines	2 Marine Way, Juneau, Alaska Joint Managers: S. B. Simmons O. F. Benecke	9 Grumman Goose 1 Consolidated PBY Canso 1 Bellanca Pacemaker 1 Lockheed Vega 1 Cessna 195 4 Piper Pacer 1 Hiller 12C	—	542,413	47,258	48,166 ton-miles	133,280	A partnership of Alaska Air Transport, Inc. and Marine Airways Corporation.
Cordova Airlines, Inc.	Anchorage, Alaska President and Gen. Manager: Merle K. Smith Vice President (Ops.): David P. Swanson	2 Douglas DC-3 1 Curtiss C-46 Commando 1 Grumman Widgeon 3 Cessna 170 2 Cessna 180 *On order:* 1 Curtiss C-46 Commando 1 Grumman Widgeon 2 Piper Super Cub	2,098	270,234 *691,465*	13,145 *4,704*	626,545	1,634,273 *8,192,804*	—
Ellis Air Lines	P.O. Box 1059, Ketchikan, Alaska President: R. E. Ellis Vice President (Ops.) G. A. Bodding	9 Grumman G-21-A 2 Cessna 180 1 Aeronca Sedan	781	647,198 *216,583*	53,078 *8,464*	682,500	1,168,633 *52,684*	—
Northern Consolidated Airlines, Inc.	Pouch 10, International Airport, Anchorage, Alaska President: Gen. Manager: Raymond I. Petersen	4 Douglas DC-3 11 Cessna T-50 *On order:* 3 Fairchild F.27	2,895	1,374,993 *716,113*	18,984 *3,179*	1,770,000	4,566,000 *10,454,000*	—
Reeve Aleutian Airways, Inc.	P.O. Box 559, Anchorage, Alaska President and Gen. Manager: Robert C. Reeve	3 Douglas DC-3 2 Sikorsky S-43 1 Grumman Goose *On order:* 1 Douglas DC-4	2,305	453,571 *204,747*	4,854 *1,886*	393,281	449,613 *1,602,960*	Operates services from Anchorage through the Aleutians to Attu and Pribilof Islands.
Wien Alaska Airlines, Inc.	Box 649, Fairbanks, Alaska President and Gen. Manager: Sigurd Wien Vice President: (Ops.): Fritz Wien	4 Curtiss C-46 Commando 2 Douglas DC-3 6 Noorduyn Norseman UC64A 5 Cessna 1 Douglas DC-3 (leased) 6 Cessna 180 (leased)	5,032	1,441,708 *2,451,403*	20,866 *15,332*	389,762 ton-miles	527,102 ton-miles *10,058,464* ton-miles	—
ALGERIA								
Compagnie Générale de Transports Aériens Air Algérie	46 Boulevard Saint-Saëns, Algiers President: J. Lignel Gen. Manager: L. Adida	3 Lockheed Constellation 4 Douglas DC-4 3 Douglas DC-3 2 S.O.30P Bretagne	—	3,599,000 (includes non-scheduled)	229,896	390,589 ton-miles	1,845,044 ton-miles	Formed in 1953 by merger of original Air Algérie and Cie. Air Transport.
ARGENTINA								
Aerolineas Argentinas Empresa del Estado	Paseo Colon 185, Buenos Aires Gen. Manager: J. C. M. Lugones Ops. Manager: D. P. Albano	14 Douglas DC-3 2 Douglas C-47 5 Douglas DC-4 6 Douglas DC-6 4 Convair 240 7 Short Sandringham	37,714	11,839,072 *71,185*	440,044 *4,844*	1,118,582 *2,330*	4,746,044 *66,970*	Now a State Corporation, under the Ministry of Aeronautics.
Compania Aerotransportes del Literal Argentino (ALA)	—	— *On order:* 6 Aero Commander	—	—	—	—	—	Private company to operate between Mendoza and Montevideo.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
ARGENTINA—*cont.*								
Lineas Aereas Aeronorte	—	D. H. Beavers Cessna 310's Cessna 180's	—	—	—	—	—	Private company. Operates from Misionesa and serves Iguarzu, Posedas, Corrientes and Resistencia.
Transcontinental S.A.	—	6 Curtiss CW-20T *On order:* 4 Convair 880	—	—	—	—	—	Private company, operating CW20's for domestic use. Has received route certification for Buenos Aires-New York and Buenos Aires-San Francisco routes.
Transporte Aerea Costa Antlantica	—	—	—	—	—	—	—	Private company. To operate between Buenos Aires and Bahia Blanca via Mar de Ajo.
AUSTRALIA								
Ansett Airways Pty. Ltd.	Melbourne Airport, Victoria. Managing Director: R. M. Ansett Manager: J. A. West Lau	4 Douglas DC-3 2 Convair 340 2 Short Sandringham *On order:* 4 Convair 440	5,728	4,672,857	230,984	54,238	18,187,899	—
Australian National Airways Pty., Ltd. (A.N.A.)	289 William Street, Melbourne, Victoria. Chairman: P. W. Haddy Chief Executive: F. Kay Ops. Manager: G. H. Archibald	4 Douglas DC-6B 2 Douglas DC-6 7 Douglas DC-4 1 Douglas DC-4 (Freight) 12 Douglas DC-3 2 Douglas DC-3 (Freight) 3 Bristol Freighter 1 Bristol Sycamore Helicopter	13,163	13,147,974 *537,156*	605,971 *15,174*	2,139,438	87,488,759 *2,145,033*	Shareholder in Air Beef Pty. Ltd.
Butler Air Transport, Ltd.	Kingsford Smith Airport, Mascot, Sydney, N.S.W. Chairman and Man. Director: C. A. Butler Gen. Manager: T. Williams Ops. Manager: T. R. Young	2 Vickers Viscount 747 5 Douglas DC-3	Approx. 8,842	—	—	—	—	Queensland Airlines Pty., Ltd. is a subsidiary.
Connellan Airways Ltd.	Townsite Aerodrome, Alice Springs, N.T. Gov. Director: E. J. Connellan Manager: I. M. Leslie	2 D.H. Rapide 2 Beechcraft C18S 1 Beechcraft D17S 1 Auster Aiglet 2 D.H. Tiger Moth 1 Cessna 180 *On order:* 1 Cessna 180	10,626	276,800 n.a.	1,104 n.a.	74,600 n.a.	119,400 n.a.	Figures for year ended June 30th, 1956.
East-West Airlines Ltd.	Tamworth, N.S.W. Chairman: D. M. Shand Gen. Manager: A. J. Smith	3 Douglas DC-3 2 Lockheed Hudson Mk. 4 *On order:* 1 Douglas DC-3	2,418	961,350	56,440	—	1,554,667	—
Guinea Airways Ltd.	Airways House, 132 North Terrace, Adelaide, S.A. Chairman: S. Powell	5 Douglas DC-3 2 Auster Autocar	1,656	977,346	94,292	183,200	2,822,400	—
MacRobertson Miller Airlines Ltd. (M.M.A.)	194, St. George's Terrace, Perth, Western Australia Man. Director: C. N. Kleinig Ops. Manager: K. D. Cohen	5 Douglas DC-3 3 D.H. Dove 3 Avro Anson	20,177	2,625,280 *241,672*	46,556 *1,396*	203,678 *980*	3,700,984 *3,058,051*	Subsidiary Companies— Commercial Aviation Pty., Ltd., and Airlines (W.A.) Ltd. Associate Company — Air Beef Pty. Ltd.
Qantas Empire Airways Limited (Q.E.A.)	Shell House, 2, Carrington St., Sydney, N.S.W. Chairman: Sir Wilmot Hudson Fysh, K.B.E., D.F.C. Chief Executive and Gen. Manager: C. O. Turner	14 Lockheed Super Constellation 5 Douglas DC-4 8 Douglas DC-3 2 Convair Catalina 4 D.H. Beaver 1 D.H. Drover *On order:* 2 Lockheed Super Constellation 7 Boeing 707	60,111	13,391,033 *468,887*	129,271 *26,909*	2,849,106 *130,196*	6,652,057 *11,214,299*	A public company in which Australian Government holds all shares. Took over Trans-Pacific routes of B.C.P.A. on April 1, 1954.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
AUSTRALIA—*cont.*								
Queensland Airlines Pty. Ltd.	Brisbane Airport, Queensland Man. Director: Capt. R. S. Adair, O.B.E. Ops. Manager: Capt. M. B. Mitchell	3 Douglas DC-3 (Extra aircraft chartered when necessary)	4,128	796,527	58,629	35,800	2,714,000	An Associate of Butler Air Transport Ltd.
Southern Airlines Ltd.	Melbourne Airport, Victoria Chairman: Sir Reginald Barnewall Man. Director: R. R. Barnewall	2 D.H. Dove 1 Avro Anson 1 Auster Autocar	1,627	176,500 *5,000*	3,127	150	24,777 *8,500*	This Company, operated on a Co-operative basis, is owned by the cities and towns served.
Trans-Australia Airlines (T.A.A.)	339 Swanston Street Melbourne, Victoria Chairman: W. D. McDonald Gen. Manager: J. P. Ryland, D.F.C.	9 Vickers Viscount 720 and 756 2 Convair 240 4 Douglas DC-4 22 Douglas DC-3 4 D.H. Drover 1 Hiller 12C *On order:* 4 Vickers Viscount 756 1 Hiller 12C 6 Fokker F-27 Friendship	31,391	16,593,100 *69,961*	773,144 *1,188*	2,400,867	40,685,031 *308,654*	State-owned. Trans-Australia Airlines (T.A.A.) is the operating or trade name of the Australian National Airlines Commission instituted under the Australian National Airlines Act 1945-1952
Woods Airways Pty. Ltd.	National House, 49 William Street, Perth, Western Australia Man. Director: Capt. J. Woods	2 Avro Anson	52	21,300	4,286	1,218	21,143	Operates the shortest scheduled airline route in the world, between Perth and Rottnest Island
AUSTRIA								
Österreichische Luftverkehrs A.G. (Austrian Airlines)	Vienna President: Dr. Josef Joham Managers: Dipl. Ing. T. Trimmel and Sepp Froeschl.	4 Vickers Viscount 779	—	—	—	—	—	Founded in September 1957 by agreement between Air Austria and Austrian Airways, neither of which had started operations. SAS and Fred Olsen Airtransport each have 15% interests.
BAHRAIN								
Gulf Aviation Co. Ltd.	c/o B.O.A.C., Manama, Bahrain, Persian Gulf Chairman: G. B. Thompson Exec. Director and Secretary: E. H. W. Lewis	2 D.H. Heron 4 D.H. Dove	870	311,300	34,016	152,908	243,467	A partially-owned subsidiary of B.O.A.C.
BELGIUM								
Société Anonyme Belge d'Exploitation de la Navigation Aérienne—SABENA	Air Terminus, Brussels Chairman: Gilbert Périer Man. Director: Gaston Claeys Gen. Manager: Willem Deswarte	10 Douglas C-47 18 Douglas DC-3 8 Douglas DC-4 3 Douglas DC-6 8 Douglas DC-6B 2 Douglas DC-6C 3 Douglas DC-7C 4 Convair 240 12 Convair 440 4 Sikorsky S-58 *On order:* 7 Douglas DC-7C 4 Sikorsky S-58 4 Boeing 707-320	77,671	19,825,709	526,594	3,897,452 ton-miles	17,529,395 ton-miles	State and private investors each have 50% interest.
Société Belge de Transports par Air S.A. (SOBELAIR)	137 Rue Royale, Brussels G. Claeys A. Philippe P. Bertin J. Carlier	2 Douglas DC-4 *On order:* 3 Cessna 310	—	— *447,635*	— *3,767*	—	— *303,325*	Private company operating between Belgium and the Belgian Congo.
BOLIVIA								
Lloyd Aéreo Boliviano S.A. (L.A.B.)	Casilla 132, Cochabamba President: Edmundo Gonzalez G. Gen. Manager: Rudolfo Galindo Q.	2 Douglas DC-4 4 Douglas DC-3 7 Douglas C-47 5 Boeing B-17 *On order:* 1 Boeing B-17	7,877	1,440,353 *2,328,209*	139,665 *20,884*	101,897 *7,689*	7,345,307 *51,680,713*	—
BRAZIL								
Correio Aéreo Nacional	—	40 Douglas DC-3 20 Beechcraft 18 8 Beechcraft Bonanza 2 Consolidated Canso	Over 45,000 (duplicated)	—	4,000,000	8,800,000	220,000,000	Transport branch of the Brazilian Armed Forces responsible for air services in areas where commercial operations would not be justified. All data are approximate.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
BRAZIL—*cont.*								
Empresa de Transportes Aéreos Catarinense, S.A. (T.A.C.)	Felipe Schmidt 14, Florianapolis Santa Catarina President: Dr. J. D. F. Lima Ops. Manager: E. Neves	Douglas DC-3	—	—	—	—	—	Operates coastal routes from Florianopolis to Rio, Porto Alegre and Bage, with technical assistance and crews from Cruzeiro do Sul.
Empresa de Transportes Aéreos Norte do Brasil S.A. (Aéronorte)	Rua Oswaldo Cruz, 341, São Luiz, Maranhão President: Capt. Linneu Gomes Gen. Manager: Noél Friere	4 Douglas DC-3	5,667	—	—	—	—	A wholly-owned subsidiary of Aérovias, operating an extensive feeder network.
Empresa de Transportes Aérovias Brasil S.A. (Aérovias)	Rua Conselheiro Crispiniano 379, 2° Andar, São Paulo President: A. Junqueria Filho	—	—	—	—	—	—	See Real Aérovias Nacional
Lóide Aéreo Nacional S.A.	Avenida 13 de Maio, 27° Andar, Rio de Janeiro Marcilio Gibson Jacques Carlos Berreto Rosa	20 Curtiss C-46 Commando *On order:* 4 Douglas DC-4 4 Douglas DC-6C	26,680	5,022,743 *1,065,138*	n.a. n.a.	330,624	33,898,424 *2,587,614*	—
Nacional Transportes Aéreos S.A.	—	—	—	—	—	—	—	This company has now been taken over by Real Aérovias Nacional
Navegacão Aérea Brasileira S.A. (N.A.B.)	Santos Dumont Airport, Rio de Janeiro Gen. Manager: Cmdr. G. X. de Oliveira	4 Douglas DC-3 1 Beechcraft 1 Lockheed Electra	—	—	—	—	—	Operates from Rio to Vitoria and Belo Horizonte
Panair do Brasil, S.A. (P.A.B.)	Santos Dumont Airport, Rio de Janeiro President: A. H. Machado Director-Superintendent: C. P. de Mello Ops. Manager: D. A. Vilhena	11 Lockheed Constellation 12 Douglas DC-3 4 Convair PBY-5A *On order:* 4 Douglas DC-7C	53,055	12,152,337 *701,671*	201,299	1,034,802	22,613,465	An affiliate of Pan American World Airways which holds a 48% interest.
Real Aérovias Nacional (REAL)	Rua Conselheiro Crispiniano, 379, São Paulo President: Comte Linneu Gomes	87 Douglas C-47 6 Convair 340 4 Convair 440 4 Douglas DC-4 10 Curtiss C-46 Commando *On order:* 5 Douglas DC-6B 8 Convair 440 4 Convair 880	79,823	25,897,485 *1,249,252*	1,599,694 *24,093*	643,333 *5,538*	49,367,200 *12,077,105*	Formerly known as Real S.A. Transportes Aéreos. Fleet and traffic figures are for Real, Nacional and Aérovias combined. Real holds 87% of Aérovias shares, but companies operate under own names. National Transportes Aéreos has been absorbed by Real.
S.A. Empresa de Viação Aérea Rio Grandense (VARIG)	P.O. Box 243, Av. Borges de Medeiros 410, 16° Andar, Porto Alegre, RGS. President: R. M. Berta Ops. Manager: G. Herzfeldt	23 Douglas C-47 14 Curtiss C-46 Commando 5 Convair 240 3 Lockheed L-1049G Super Constellation *On order:* 3 Lockheed L-1049 Super Constellation 8 Vickers Viscount 3 Boeing 707	18,656	11,475,450 (inc. non-scheduled)	511,414 (inc. non-scheduled)	681,719 (inc. non-scheduled)	15,067,468 (inc. non-scheduled)	—
S.A. Viação Aérea Gaúcha (SAVAG)	Edifício Camara do Con ércio, Rio Grande do Sul President: E. C. Becker Ops. Manager: Maria C. Cramer	6 Douglas DC-3	1,143	371,277 *14,738*	27,655 *865*	36,279 *518*	1,604,878 *49,618*	Technical and operational assistance is given by Cruzeiro do Sul.
Serviços Aéreos Cruzeiro do Sul, Ltda. (Cruzeiro)	128, Avenida Rio Branco, Rio de Janeiro President: Dr. J. B. R. Dantas Ops. Director: Col. F. A. Rocha	34 Douglas DC-3 4 Convair 340 4 Beechcraft AT-11 *On order:* 10 Frye Safari	23,902	11,194,000 *471,000*	412,684	155,226 ton-miles	5,627,889 ton-miles	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
BRAZIL—*cont.*								
Viação Aérea São Paulo S.A. (VASP)	Rua Líbero Badaró 89, São Paulo Director President: Cel. Oswaldo Pamplona Pinto Director Vice-President: Dr. José Castilho Cabral	15 Douglas C-47 9 Saab Scandia SA-2 *On order:* 5 Vickers Viscount 810	8,477	5,275,427	368,729	28,234	6,687,560	State of São Paulo holds 51% interest.
BRITISH CENTRAL AFRICA								
Central African Airways Corporation	Salisbury Airport, Salisbury, Rhodesia & Nyasaland Gen. Manager: P. J. B. Wimbush	5 Vickers Viscount 748 6 Vickers Viking 5 Douglas DC-3 5 D.H. Beaver	16,930	5,195,826 *931,256*	172,887 *15,450*	1,272,546 *3,579*	2,803,693 *290,847*	Owned by the Federation of Rhodesia and Nyasaland.
Hunting-Clan African Airways (Pvt.) Ltd.	35, Jameson Ave., Salisbury, Federation of Rhodesia and Nyasaland Chairman: C. Barnard Gen. Manager: T. P. Lawler	Douglas DC-3 D.H. 89 Rapide	—	—	—	—	—	Independent company, operating third class passenger and cargo services in association with the parent Hunting-Clan company.
BRITISH EAST AFRICA								
Caspar Air Charters & Agencies Ltd. (Caspair)	Mansion House, P.O. Box 2238, Nairobi, Kenya Directors: L. K. Campling F. K. Campling H. Vanderwal	3 D.H. 89A Rapide Mk. IV 1 Cessna 180 2 Beechcraft Bonanza 1 North American Navion 1 Piper Pacer	1,265	161,168 *205,548*	2,326 *1,332*	11,751	39,406 *66*	—
East African Airways Corporation	Sadler House, Sadler Street, P.O. Box 30030 Nairobi, Kenya Gen. Manager: M. C. P. Mostert, O.B.E. Ops. Manager: E. E. Morris, M.V.O.	9 Douglas DC-3 4 D.H. 89 Rapide *On order:* 4 Canadair Argonaut	15,381	2,792,575 *225,255*	106,162 *4,555*	880,969 *743*	5,294,645 *79,800*	—
BRITISH GUIANA								
British Guiana Airways, Ltd.	32, Main Street, Georgetown Man. Director: Lt. Col. A. J. Williams, O.B.E. Gen. Manager: H. E. Wendt	3 Douglas C-47A 2 Grumman G-21A Goose	—	—	—	—	—	Ownership and control acquired by the British Guiana Government in 1955.
BRITISH HONDURAS								
British Colonial Airlines, Inc.	—	—	—	—	—	—	—	Airline Division of this company was bought by British Honduras Airways in October 1956.
British Honduras Airways Ltd.	7 Cork Street, Belize, British Honduras Chairman: J. W. MacMillan, O.B.E. Directors: R. H. Eyles, O.B.E., J.P. T. B. Baker	4 Cessna 170	—	—	—	—	—	No statistics available. Bought assets of Airline Division of British Colonial Airlines in October 1956 and is operating services formerly operated by that company.
BRITISH WEST AFRICA								
West African Airways Corporation	Airways House, Lagos Airport, Nigeria Gen. Manager: D. Malcolm Brown	8 D.H. Heron 2 Bristol 170 5 D.H. Dove *On order:* 5 Douglas DC-3	7,798	1,611,057 *324,787*	52,314	1,009,527	1,601,613	Owned jointly by Governments of Nigeria (68%), Ghana (29½%), Sierra Leone (2%) and Gambia (5%).
BRITISH WEST INDIES								
Bahamas Airways, Ltd.	Oakes Field, Nassau, Bahamas Chairman: H. G. Christie, C.B.E., M.H.A. Gen. Manager: Capt. Peter C. Fair	2 Grumman Goose 3 D.H. Heron *On order:* 1 Consolidated Catalina	3,874	560,300	24,892	—	—	Associated company of B.O.A.C. Figures are for year ending March 31, 1956.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
BRITISH WEST INDIES—*cont.*								
British West Indian Airways Ltd. (B.W.I.A.)	Airways House, 17 Chacon Street, Port of Spain, Trinidad President: Gerard d'Erlanger, C.B.E. Chairman: Sir Errol dos Santos, C.B.E. Gen. Manager: J. H. Rahr	4 Vickers Viscount 702 5 Vickers Viking 3 Douglas DC-3 *On order:* 4 Vickers Viscount 754	8,936	1,831,743 *1,153,362*	88,833 *4,778*	355,692 *1,302*	1,126,723 *48,316*	A wholly-owned associate of B.O.A.C.
Leeward Islands Air Transport Company	St. John's, Antigua	Piper Apache	—	—	—	—	—	Operates services between Antigua Montserrat, St. Kitts, Anguilla and Puerto Rico.
BULGARIA								
Bulgarski Vzduszni Linii (TABSO)	12, Place Narodno, Sabranie, Sofia	Ilyushin Il-14 Li-2	—	—	—	—	—	State-owned
BURMA								
Union of Burma Airways	104, Strand Road, Rangoon Gen. Manager: U Taw	8 Douglas C-47 Dakota 3 D.H. 104 Dove 2 Handley Page Marathon Mk.1A 1 Auster 5 1 Convair PBY5A Catalina 1 Ilyushin Il-14 *On order:* 3 Vickers Viscount 700D	8,797	2,164,865 *327,546*	148,075 *13,512*	426,827 *10,623*	4,928,951 *1,630,584*	Controlled by a Government Board.
CAMBODIA								
Royal Air Cambodge	Phnom-Penh Chairman: Huot Sam Ath Gen. Manager: Cyril Martin-Onraet	1 Douglas DC-3 1 D.H. Beaver	—	39,014 ton-miles	1,984	825	15,284	Began operations on November 1, 1956. Data are for last two months of 1956 only.
CANADA								
Canadian Pacific Air Lines, Ltd. (C.P.A.L.)	Vancouver Airport, B.C. President: G. W. G. McConachie Exec. Vice-President: R. W. Ryan Vice-President: (Ops.) R. B. Phillips	7 Douglas DC-6B 1 Douglas DC-4 13 Douglas DC-3 5 Convair 240 8 Curtiss C-46F 2 Convair Canso 2 D.H. Otter *On order:* 8 Douglas DC-6B 6 Bristol Britannia 314	39,381	10,762,694 *3,417,278*	251,542 *29,046*	2,807,441 *56,437*	9,899,936 *23,750,720*	Wholly-owned subsidiary of Canadian Pacific Railway Company.
Leavens Bros. Ltd.	3220, Dufferin St., Toronto, Ontario President and Gen. Manager: C. R. Leavens	3 Cessna T-50	50	66,415 *11,976*	3,443 *79*	79,927	91,118 *1,204*	—
Maritime Central Airways, Ltd.	Charlottetown, Prince Edward Island President: J. K. Curran Man. Director: C. F. Burke Ops. Manager: H. S. Jones	8 Douglas DC-3 4 Douglas DC-4 3 Curtiss C-46 1 Avro York 1 D.H. Beaver 3 Beechcraft C-18S *On order:* 2 Douglas DC-6B	1,081	592,219 *5,048,985*	32,915 *47,338*	830,414	768,700 *31,566,932*	—
Matane Air Services Limited	Matane, Quebec President: E. Burnett Man. Director: G. Burnett	4 Lockheed Electra 2 Cessna T-50	234	154,032 *76,831*	14,561 *5,295*	—	122,802	—
Northern Wings Ltd.	Seven Islands, P.Q. President: Dr. Gaétan Cyr Vice-President: J. Lucien Roy	1 Avro Anson 2 Douglas DC-3 3 D.H. Beaver 1 Beechcraft D17S 2 Convair Canso 3 Noorduyn Norseman	—	321,529 *793,638*	4,109 *9,632*	202,193	89,795 *7,323,437*	—
Pacific Western Airlines, Ltd.	Vancouver Airport, B.C. President and Gen. Manager: R. Baker Ops. Manager (IFR): J. F. Crosby Ops. Manager (VFR): A. J. Moul	80 misc. twin and single-engined aircraft	6,935	651,759 *1,507,628*	76,512 *58,420*	149,717	351,829 *411,018*	Took over Queen Charlotte Airlines Ltd. in 1955 and Associated Airways early in 1956.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
CANADA—*cont.*								
Quebecair Inc.	Rimouski, P.Q. President: Romeo Crevier Vice-President: Aubert Brillant	8 Douglas DC-3 2 Convair PBY Catalina 1 Beechcraft D-18S *On order:* 2 Fokker F-27 Friendship	1,508	1,594,265 (inc. non-scheduled)	133,916 (inc. non-scheduled)	853,421	8,653,597 (inc. non-scheduled)	—
Saskatchewan Government Airways	Box 850, Price Albert, Saskatchewan Gen. Manager: Ian McLeod Ops. Manager: F. R. Baudais	1 Douglas DC-3 1 D.H. Otter 4 D.H. Beaver 1 Cessna 170 1 Stinson 4 Noorduyn Norseman 7 Cessna 180 2 Cessna 140 1 Piper Super Cub *On order:* 1 D.H. Beaver 2 Cessna 180	—	— *1,313,056*	— *16,829*	— *99,602*	— *6,208,245*	—
Trans-Air Ltd.	No. 5 Hangar, Winnipeg Airport, Winnipeg 12 President: R. D. Turner Vice-President: G. H. Sellers	2 Avro Anson 3 D.H. Beaver 1 Bellanca 1 Bristol 170 4 Convair Canso 4 Cessna 1 Douglas DC-3 1 Douglas DC-4 1 Lockheed 12A 15 Noorduyn Norseman 2 Waco 1 Avro York	—	439,443 *1,763,464*	8,132 *7,738*	308,805 (inc. non-scheduled)	968,703 *16,620,137*	Formed by the amalgamation of Central Northern Airways, Ltd. and Arctic Wings Ltd.
Trans-Canada Air Lines (T.C.A.)	International Aviation Building, Montreal, P.Q. President: G. R. McGregor Vice-President (Ops.): H. W. Seagrim	21 Canadair DC-4M2 9 Lockheed Super Constellation 15 Vickers Viscount 724 10 Vickers Viscount 757 24 Douglas DC-3 *On order:* 26 Vickers Viscount 757 20 Vickers Vanguard 6 Douglas DC-8	25,187	41,039,000 *699,350*	2,072,912 n.a.	19,197,000	26,869,000	Canada's national airline, an autonomous publicly-owned company.
Wheeler Airlines Ltd.	St. Jovite, P.Q. President: F. H. Wheeler Man. Director: B. Rychlicki	3 Douglas DC-4 3 Douglas DC-3 2 Curtiss C-46 Commando 2 Convair PBY5 Canso 1 D.H. Otter 1 D.H. Beaver 5 Noorduyn Norseman 1 Cessna 185 7 Stearman spray-planes 1 Beechcraft D18	—	2,500,000	—	—	—	Operations largely charter to Northern Canada and Eastern Arctic, carrying freight and passengers.
CEYLON								
Air Ceylon, Ltd.	Hemas Building York Street, Colombo 1. Man. Director: J. L. M. Fernando Manager: K. de Croos	2 Douglas DC-3 1 Lockheed Constellation (leased from K.L.M.)	1,994	1,152,642	29,240	82,661 ton-miles	848,596 ton-miles	—
CHILE								
Cia. Nacional de Turismo Aereo (CINTA)	Santiago President: A. Ossa Gen. Manager: J. Costabal	2 Douglas DC-4 Douglas DC-3 Curtiss C-46 Commando Lockheed 10 Beechcraft Bonanza	—	—	—	—	—	Formed to operate low-fare services between Santiago and Miami, via Arica, Talara and Panama.
Linea Aérea Nacional-Chile (L.A.N.)	Los Cerrillos, Santiago Vice-President: A. Fernández Technical Man.: A. Bermúdez	2 Lockheed Electra 1 Beechcraft Bonanza 16 Douglas DC-3 3 Douglas DC-6B 4 Martin 202	15,537	5,242,709	267,766	274,436	7,133,366	State-owned.
CHINA								
Minhaiduy Civil Aviation Administration of China (CAAC)	Peking	Ilyushin Il-14 Ilyushin Il-12 Li-2	Approx. 9,500	—	—	—	—	Successor to joint Soviet-Chinese airline Skoga. Operates internally and to Irkiutsk Rangoon and Hanoi.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
COLOMBIA								
Aerovias Nacionales de Colombia S.A. (Avianca)	Carrera 7, No. 16-14, Bogotá President: J. G. R. Jaramillo Ops. Manager: R. Barvo	4 Lockheed Super Constellation 10 Douglas DC-4 2 Douglas DC-4 Freighter 25 Douglas DC-3 8 Douglas DC-3 Freighter	31,998	14,419,397	972,083	1,500,000 approx.	172,624,590	Aerotaxi and Helicópteros Nacionales de Colombia are subsidiaries. Pan American holds 38.37% interest.
Lloyd Aereo Colombiano (LAC)	Bogotá	Curtiss C-46 Commando Douglas DC-3 Cessna 310 *On order:* 3 Vickers Viscount 770	—	—	—	—	—	Formed in 1954.
RAS-Rutas Aereas Sam, Ltda.	Boyacá x Carabobo, Medellin Gen. Manager: G. Vergara Mendez	3 Douglas DC-3 3 Douglas DC-4 *On order:* 3 Douglas DC-6	7,922	1,577,738 *106,241*	121,567	—	—	—
Sociedad Aeronautica Medellin S.A. (S.A.M.)	Calle 51, 53-54, Apartado Aereo No. 1085, Medellin Gen. Manager: Pedro A. Mena V.	6 Curtiss C-46 3 Douglas C-47	8,754	— *2,019,490*	—	— *5,388,74*	— *49,852,441*	Operates freight services.
Uraba, Medellin and Central Airways, Inc. (UMCA)	320, Caraboba, Medellin President: E. Balluder	1 Douglas DC-3	328	—	—	—	—	Aircraft leased from Pan American World Airways, which has a substantial interest in UMCA.
COSTA RICA								
Lineas Aéreas Costarricenses S.A. (LACSA)	P.O. Box 1531, Avenida 1a, Calle Central, San José, Costa Rica President: F. Terán Gen. Manager: R. E. Smith	2 Convair 340 4 Curtiss C-46 3 Douglas DC-3	4,439	1,552,589 *613,320*	106,741 *11,407*	424,401	11,857,085 *5,454,417*	Pan American World Airways holds a 33.33% interest.
CUBA								
Aerovias "Q" S.A.	Cienfuegos 70, Havana President and Gen. Manager: M. Quevedo, Jr. Ops. Manager: J. E. Alvarez Regato	4 Curtiss C-46	980	539,267 *24,783*	141,807 *222*	147,266	692,747	—
Compañia Cubana de Aviacion S.A. (Cubana)	Jose Marti Airport, Rancho Boyeros, Havana President and Chairman: José López Vilaboy	2 Lockheed L-1049G Super Constellation 1 Lockheed L-049 Constellation 3 Vickers Viscount 755 6 Douglas DC-3 1 Curtiss C-46 (rented to "Carga por Avión") *On order:* 1 Lockheed L-1049G Super Constellation 4 Vickers Viscount 810	10,995	4,873,431	279,865	95,195 ton-miles	1,004,761 ton-miles	—
Expreso Aereo Inter-Americano, S.A. (Expreso)	Apartado No. 722, Havana President: Gerardo Díaz González	3 Curtiss C-46	467	285,886 *2,027*	—	22,134	12,292,255 *9,000*	Official airmail carrier.
CYPRUS								
Cyprus Airways Ltd.	36, Homer Avenue, Nicosia Chairman: Dr. C. Raeburn, C.B.E., D.Sc. Gen. Manager: J. A. Vick	4 Douglas DC-3 *On order:* 2 Vickers Viscount 754	2,674	867,325 *200,950*	27,576 n.a.	912,713	1,379,211 n.a.	Jointly owned by B.E.A. (23%), B.O.A.C. (23%), Cyprus Government (32%) and Cypriot citizens (22%).
CZECHOSLOVAKIA								
Ceskoslovenské Aerolinie (C.S.A.)	Ruzyne Airport, Prague Gen. Manager: Josef Procházka Deputy Gen. Manager: Al. Palichleb	8 Ilyushin Il-12 7 Li-2 21 Douglas DC-3 *On order:* 3 Tupolev Tu-104 10 Ilyushin Il-14	—	4,407,000 *385,000*	217,520	7,582,235	4,576,212	State-owned.
DENMARK								
Det Danske Luftfartselskab A/S. (D.D.L.)	Dagmarhus, Copenhagen V. Chairman: Per Kampmann President: K. Lybye	—	—	—	—	—	—	A non-operating holding company in the SAS consortium. See under "Scandinavia".

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
DOMINICAN REPUBLIC								
Compañia Dominicana de Aviacion, C. por A.	General Andrews Airport, Ciudad Trujillo President: C. A. McLaughlin Traffic Manager: R. J. Prieto	2 Douglas DC-3 2 Curtiss C-46 3 Curtiss C-46 (Freight) 1 D.H. Beaver	1,648	896,701 (inc. non-scheduled)	45,788 (inc. non-scheduled)	—	5,774,384 (inc. non-scheduled)	Pan American World Airways has a 40% interest.
ECUADOR								
Aerovias Ecuatorianas (A.R.E.A.)	661, Calle Garcia Moreno, P.O. Box 2226, Quito President: Luis Arias Gen. Manager: A. Arias	2 Boeing Stratoliner 3 Douglas DC-3 1 Douglas C-47 5 Avro Anson 3 Ryan Navion *On order:* 1 Fairchild F-27	3,533	—	—	—	—	—
EGYPT								
Misrair S.A.E.	Almaza Airport, Heliopolis Gen. Manager: A/Cdre. Mahmoud Sedki El Meligi	2 Vickers Viscount 739 7 Vickers Viking 1B 1 Beechcraft D18S	11,161	2,046,697 *188,267*	82,686	176,516	3,236,470	—
EL SALVADOR								
Taca International Airlines S.A.	San Salvador President: Ricardo H. Kriete Exec. Vice-Pres: G. R. Woody	3 Douglas DC-4 1 Curtiss C-46	3,980	—	—	—	—	A subsidiary of the TACA Corporation, Alabama, U.S.A.
ETHIOPIA								
Ethiopian Air Lines Inc.	P.O. Box 1755, Addis Ababa President and Chairman: H. E. Dejazmatch Zewde Gebre Selassie Vice-President and Director: H. E. Ato Menasse Lemma Ops. Manager: H. F. Noon	8 Douglas DC-3 3 Convair 240 *On order:* 3 Douglas DC-6B	13,254	2,819,875 *126,605*	70,615 *1,815*	163,824	11,158,903 *1,481,745*	—
FIJI ISLANDS								
Fiji Airways	Princess Road, Suva Manager: Len Dobbin	3 D.H. A3 Drover	1,802	425,996	20,108	107,350	292,353	—
FINLAND								
Aero Osakeyhtio (Finnair)	Mannerheimintie 9B, Helsinki President: Lt. Gen. L. Grandell	1 Convair 440 3 Convair 340 10 Douglas DC-3 *On order:* 2 Convair 440	9,438	4,662,603 *76,864*	333,066 *3,208*	1,248,258 *147,740*	4,058,082 *37,657*	State owns 75% interest.
Kar-Air Oy (Karhumäki Airways)	3 Lönnrotinkatu, Helsinki Chairman: Niilo Karhumäki Man. Director: Uuno Karhumäki	3 Douglas DC-3 1 Lockheed Lodestar *On order:* 1 Convair 440	—	—	—	—	—	New company formed by original Veljekset Karhumäki Oy, with majority holding, Finland Steamship Co. and a private individual.
Veljekset Karhumäki Oy (Karhumäki Airways.)	3, Lönnrotinkatu, Helsinki Chairman: Niilo Karhumäki Man. Director: Uuno Karhumäki	3 Douglas DC-3 1 Lockheed Lodestar *On order:* 1 Convair 440	895	338,379 *170,699*	23,031 *4,270*	37,480 *79,120*	52,265 *4,830*	Now superseded by Kair-Air Oy.
FRANCE								
Compagnie de Transports Aériens Intercontinentaux (T.A.I.)	23, rue de la Paix, Paris 2e President: P. Bernard Gen. Manager: Général G. Fayet	3 Douglas DC-3 2 Douglas DC-4 4 Douglas DC-6B 1 Douglas DC-6 *On order:* 3 Douglas DC-7C Douglas DC-8	34,175	5,305,784	53,185 *50,251*	606,196	3,132,983	—
Compagnie Nationale Air France (Air France)	2, Rue Marbeuf, Paris 8°. President: Max Hymans Director General: Louis Lesieux	19 Lockheed Super Constellation 17 Lockheed Constellation 11 Vickers Viscount 708 12 Breguet Deux-Ponts 20 Douglas DC-4 40 Douglas DC-3 5 Morane 5 Saab Safir *On order:* 17 Boeing 707 12 SE.210 Caravelle 4 Lockheed Super Constellation 10 Lockheed 1649A Starliner	175,260	44,786,940 *2,922,680*	2,199,547 *7,809*	41,738,400 *24,600*	111,515,800 *575,025*	

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
FRANCE—*cont.*								
Société Auxiliaire de Gérance et de Transports Aeriens (SAGETA)	12, Boulevard de la Madeleine, Paris 9e. President: Général Pierre Marette	6 Sud-Est Armagnac	—	1,354,846	59,062	—	2,828,528	—
Société des Lignes Aériennes Intérieures (Air-Inter)	96, Boulevard Haussmann, Paris 8e. President: René Lemaire	—	—	—	—	—	—	Intended for services in French territories overseas, this company has not yet commenced operations and possesses no aircraft.
Union Aéromaritime de Transport (U.A.T./ Aéromaritime)	5, Boulevard Malesherbes, Paris 8e. Chairman: L. Vidal	7 Douglas DC-6 2 Douglas DC-4 8 D.H. Heron 4 Nord 2501 *On order:* 2 Douglas DC-6B 5 Douglas DC-8	—	8,061,455	124,720	1,164,361	19,153,229	—
FRENCH EQUATORIAL AFRICA								
Transportes Aériens du Gabon	Libreville, Gabon	4 D.H. 89 Rapide 4 Cessna 170B 2 Auster Autocrat 1 Percival Proctor 5	—	—	—	—	—	This company began operations in 1951 and now links all surrounding places with Libreville.
FRENCH GUIANA								
Société Aérienne des Transportes Guyane-Antilles (SATGA)	Cayenne	D.H. 89 Rapide Vultee L-13	57	—	—	—	—	Flies local services in French Guiana.
GERMAN DEMOCRATIC REPUBLIC								
Deutsche Lufthansa	Berlin	Ilyushin Il-14	—	—	—	—	—	Began operating scheduled international services in 1956, with technical assistance of Aeroflot.
GERMAN FEDERAL REPUBLIC								
Deutsche Flugdienst G.m.b.H.	Weissfrauenstrasse 3, Frankfurt (Main) Man. Director: H. T. Wolf	3 Vickers Viking 1B *On order:* 1 Vickers Viking 1B	—	—	— *369,844*	—	— n.a.	Began charter operations on April 1, 1956. Aircrew and maintenance staff provided by Airwork Ltd.
Deutsche Lufthansa A.G.	Claudiusstrasse 1, Cologne Hans M. Bongers Gerhard Hoeltje	4 Convair 340 8 Lockheed L-1049G Super Constellation 3 Douglas DC-3 *On order:* 9 Vickers Viscount 814 4 Lockheed L-1649A Starliner 4 Boeing 707 5 Convair 440	27,526	6,442,673 *75,354*	205,509	2,322,863	4,380,593	—
Lufttransport Union G.m.b.H. (L.T.U.)	Frankfurt Airport Gen. Manager: B. A. Dromgoole	3 Vickers Viking *On order:* 1 Bristol Mk. 21 Wayfarer 1 D.H. Dove 1 Cessna 310 2 Vickers Viking	—	— *783,548*	— *19,745*	—	— *230,145*	Joint Anglo-German venture with 100% German capital.
GIBRALTAR								
Gibraltar Airways, Ltd.	Cloister Building, Irish Town, Gibraltar Chairman: Sir George Gaggero, O.B.E., J.P.	1 Douglas DC-3	45	—	—	—	—	B.E.A. holds 51% interest: M. H. Bland and Co. Ltd. 49%.
GREAT BRITAIN								
Air Charter, Ltd.	21, Wigmore Street, London W.1 Man. Director: F. A. Laker Ops. Manager: Capt. E. N. Jennings	6 Avro Supertraders 3 Bristol Freighter Mk. 31 6 Bristol Freighter Mk. 32 3 Douglas DC-4	—	12,694,075 short ton-miles	163,988	—	59,616,000	Operates vehicle ferry services and general charter work.
Air Couriers (Transport), Ltd.	Croydon Airport, Surrey Directors: C. P. L. Godsal F. W. Griffith.	2 D.H. Rapide 2 Miles Gemini	—	—	—	—	—	General charter, press and television flying.
Air Kruise Ltd.	No. 1 Great Cumberland Place, London, W.1. Chairman: E. C. Mekie Man. Director: W/C. H. C. Kennard	5 Douglas DC-3 3 Bristol Wayfarer *On order:* 6 Handley Page Herald	6,000	665,307 *41,000*	66,000 *4,000*	—	—	Operates in association with B.E.A. Member of British Aviation Services Group

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
GREAT BRITAIN *cont.*—								
Airviews, Ltd.	Manchester Airport, Wythenshawe, Manchester Directors: J. B. Martin B. Martin.	1 D.H. Dove 2 D.H. Rapide 1 Auster	—	—	3,300	—	600,000	Operates scheduled passenger and charter services.
Airwork Ltd.	Airwork House, 35, Piccadilly, London, W.1. Chairman and Man. Director: M. D. N. Wyatt Ops. Manager: G. E. Ford	5 Handley Page Hermes 7 Vickers Viking 10 Douglas DC-3 (Transair Ltd.) and numerous smaller aircraft 9 Hiller helicopter 4 Westland Whirlwind (Fison-Airwork) *On order:* 2 Vickers Viscount (Transair)	14,742	1,428,800 *2,861,350*	5,751 *27,412*	5,400	232,560 *345,840*	In addition Airwork operates 5 D.H. Doves and 2 Douglas DC-3's for Sudan Airways, and 8 D.H. Doves and 1 Vickers Viking for the Iraq Petroleum Co.
Aquila Airways, Ltd.	1, Great Cumberland Place, London W.1. Chairman: Eoin C. Mekie, C.B.E. Man. Director: Air Cdre. G. J. Powell, C.B.E. Manager: R. J. Clark	3 Short Solent	—	9,255,512 short ton-miles	16,517	100,000	54,000	A member of the British Aviation Services Group.
B.K.S. Air Transport Ltd.	1, Marylebone High Street, London, W.1 Managing Director: C. J. Stevens Ops. Manager: H. Dennison	5 Douglas C-47A Dakota 2 Vickers Viking	2,752	538,764 *301,718*	36,442 *14,559*	—	816,300 *464,000*	—
Britavia, Ltd.	1, Great Cumberland Place, London W.1. Chairman: Eoin C. Mekie, C.B.E. Man. Director: Air Cdre. G. J. Powell, C.B.E.	5 Handley Page Hermes IVA	—	9,187,557 short ton-miles	33,477	—	—	Member of the British Aviation Services Group.
British European Airways Corporation (B.E.A.)	Keyline House, South Ruislip, Middlesex Chairman: Lord Douglas of Kirtleside Chief Executive: A. H. Milward	27 Vickers Viscount 701 19 Airspeed Ambassador 38 Douglas DC-3 8 Douglas DC-3 (Freighter/Passenger) 3 D.H. 89A Rapide 3 D.H. 114 Heron 3 Westland WS.55 2 Bristol 171 Mk.3A 1 Bell 47 B3	26,221	29,627,259 *280,702*	2,436,402 *52,182*	14,952,000	43,208,000	State-owned.
British Overseas Airways Corporation (B.O.A.C.)	B.O.A.C. Head quarters, London Airport, Hounslow, Middlesex. Chairman: Gerard d'Erlanger, C.B.E. Deputy Chairman: Sir George Cribbett, K.B.E., C.M.G. Man. Director: Basil Smallpiece	20 Canadair Argonaut 10 Bristol Britannia 102 6 Douglas DC-7C 16 Lockheed L-749A Constellation 16 Boeing Stratocruiser *On order:* 4 Douglas DC-7C 5 Bristol Britannia 102 18 Bristol Britannia 312 19 de Havilland Comet 4 15 Boeing 707-420	67,894	37,635,843 *1,486,630*	388,342 *25,355*	8,200,000	16,210,000 (inc non-scheduled)	State-owned.
Cambrian Airways, Ltd.	Cardiff (Rhoose) Airport, Glamorgan Chairman: J. H. Watt Joint Man. Directors: L. B. Elwin and W. W. Stanley	2 Douglas DC-3 3 D.H. Heron 2 D.H. Rapide	1,612	810,000 *42,000*	40,000 *6,200*	—	336,000 *896,000*	—
Dan-Air Services, Ltd.	36-38 New Broad Street, London E.C.2 Directors: F. E. F. Newman, J. W. Davies E. O. Wallis	4 Avro York 2 Douglas DC-3	—	—	—	—	—	Operates scheduled and charter passenger and freight services.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
GREAT BRITAIN —*cont.*								
Derby Aviation Ltd.	78 Buckingham Gate, London, S.W.1. Director: G/Capt. C. A. B. Wilcock, O.B.E., A.F.C.	2 Douglas Dakota 2 Handley Page Marathon Avro Ansons	—	375,000 *65,000*	18,200 *4,760*	—	— *33,070*	—
Don Everall (Aviation) Ltd.	Elmdon Airport, Birmingham Directors: D. Everall C. Everall Ops. Manager: A. D. Atkinson	3 D.H. Rapide 1 Miles Messenger 1 Douglas DC-3 (on hire) *On order:* 1 Douglas Dakota Mk. 4	2,940	102,600 *3,000*	7,000 *60*	—	—	—
Dragon Airways Ltd.	Newcastle Airport Man. Director: Capt. M. A. Guinane Gen. Manager: Capt. R. F. Holmes	3 D.H. Heron 1 Vickers Viking	—	—	—	—	—	Data refers to 1956 operations. Company was purchased by the British Aviation Services Group in March 1957 and is now known as Silver City (Northern) Aviation Ltd.
Eagle Airways Ltd.	Marble Arch House, 40 Edgware Road, London, W.2. Chairman and Man. Director: H. Bamberg	Shares aircraft of Eagle Aviation Ltd.	10,000	1,361,306	— *4,135*	—	—	—
Eagle Aviation Ltd.	Marble Arch House, 40 Edgware Road, London, W.2. Chairman and Man. Director: H. Bamberg	18 Vickers Viking *On order:* 3 Vickers Viscount 821	—	5,858,068	98,809	—	—	—
East Anglian Flying Services Ltd. (Channel Airways)	Southend Airport, Southend on Sea, Essex Man. Director: S/Ldr. R. J. Jones, A.F.C. Director (Ops.): A. E. Hugo Parsons	6 D.H. Dove 2 Bristol 170 2 D.H. Rapide 2 Auster 1 Tiger Moth 1 Percival Proctor	1,200	412,165 *70,000*	16,331 *2,000*	—	5,000 *200,000*	—
Hunting-Clan Air Transport Ltd.	London Airport, Hounslow, Middlesex Man. Director: M. H. Curtis	3 Vickers Viscount 732 2 Vickers Viscount 759 9 Vickers Viking 4 Avro York 5 Douglas DC-3 *On order:* 2 Bristol Britannia 301 2 Douglas DC-6A	20,900	2,006,000 *770,000*	7,638 *26,394*	—	1,232,320 *300,000*	A subsidiary of Hunting-Clan Air Holdings Ltd. operating scheduled passenger services to East, Central and West Africa, and scheduled all cargo service to East Africa. Viscount 732 aircraft leased to Middle East Airlines.
Jersey Airlines (Jersey) Limited)	States Airport Jersey Chairman and Man. Director: M. L. Thomas Comm. Manager: H. I. Allan	7 D.H. 114 Heron 1 Bristol Wayfarer 2 D.H. 89A Rapide	3,033	—	157,145 *2,029*	29,980	282,120 *325,920*	—
Lancashire Aircraft Corporation Ltd.	1 Great Cumberland Place, London, W.1 Chairman: Eoin C. Mekie, C.B.E.	2 Bristol Wayfarer 2 Douglas Dakota 1 D.H. Heron Series 2	995	290,890 *79,600*	49,884 *6,432*	—	141,740 *450,000*	Member of British Aviation Services Group.
Manx Airlines Ltd.	Ronaldsway Airport Ballasalla, Isle of Man. Man. Director: G. S. Hankinson Chairman: G. H. Drummond	2 Bristol 170 Wayfarer 1 D.H. Heron 2 D.H. Rapide	766	160,000 *36,000*	20,849 *1,594*	—	2,000 *256,000*	Member of British Aviation Services Group.
Morton Air Services Ltd.	Croydon Airport, Surrey. Directors: T. W. Morton E. V. W. Morton	7 D.H. Dove 2 Airspeed Consul 3 D.H. Rapide *On order:* 2 D.H. Heron	660	—	15,000 *5,000*	—	—	—
Olley Air Service Ltd.	Croydon Airport, Surrey. Directors: T. W. Morton E. V. W. Morton J. J. Fargher	7 D.H. Dove 2 Airspeed Consul 3 D.H. Rapide *On order:* 2 D.H. Heron	660	—	15,000 *5,000*	—	—	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
GREAT BRITAIN —*cont.*								
Scottish Airlines (Prestwick) Ltd.	Prestwick Airport, Ayrshire. Man. Director: D. F. McIntyre Gen. Manager: I. C. Grant	3 Avro York 1 Douglas DC-3 *On order:* 6 Scottish Aviation Twin Pioneer	194	45,493 *1,211,000*	11,523 *5,137*	—	5,071 *3,286,000*	—
Silver City Airways Ltd.	1, Great Cumberland Place, London, W.1 Chairman: Eoin C. Mekie, C.B.E. Man. Director: Air Commodore G. J. Powell, C.B.E.	14 Bristol Freighter Mk. 32 3 Bristol Freighter Mk. 21	776	1,254,923 *201,020*	135,267	—	136,034,000 *2,914,000*	Member of British Aviation Services Group. Aircraft shared with other companies in Group.
Silver City (Northern) Aviation Ltd.	Woolsington Airport, Newcastle Chairman: Eoin C. Mekie Managing Director: Air Cdre. G. J. Powell	—	—	—	—	—	—	Formerly Dragon Airways Ltd. A member of the British Aviation Services Group.
Skyways Ltd.	7, Berkeley Street, London, W.1. Chairman: Sir Wavell Wakefield Man. Director: E. Rylands	15 Avro York 9 Handley Page Hermes 3 Douglas DC-3 2 Airspeed Consul 1 Auster 1 D.H. Rapide	2,520	454,400	48,928	—	43,900	The Bibby Line has a 49% interest in Skyways.
Starways Ltd.	Liverpool Airport, Liverpool 19. Chairman: F. H. Wilson, M.(inst.) B.E. Director: J. A. Wilson	4 Douglas Dakota	—	305,096 *399,081*	14,119 *13,394*	—	43,914 *41,427*	—
Transair Ltd.	Croydon Airport, Surrey Chairman and Man. Director: G. H. Freeman Ops. Manager: C. W. H. Bebb	10 Douglas DC-3 *On order:* 3 Vickers Viscount 804	—	—	—	—	—	Owned by Airwork Ltd., since August 1956.
GREECE								
National Greek Airlines (T.A.E.)	12, Merlin Street, Athens. President: Air Vice-Marshal N. Voyadzis Comm. Manager: S. Damaskinos	1 Douglas DC-4 14 Douglas DC-3 1 Fairchild Argus	5,467	2,535,000 *23,600*	179,888	515,259	5,581,388	Operations now taken over by Olympic Airways. (which see)
Olympic Airways, S.A.	Director (temporary): S. Damaskinos Technical Director: Gp. Capt. K. Danis	1 Douglas DC-4 14 Douglas DC-3 1 Fairchild Argus	—	—	—	—	—	This company took over on April 6, 1957, the domestic and international services hitherto operated by National Greek Airlines, TAE.
GUATEMALA								
Empresa Guatemalteca de Aviacion (Aviateca)	12 Calle 2-55 Zona 1, Guatemala City President: Col. Alfredo Gemmell General Ops. Manager: Col. Jorge Ruiz M.	5 Douglas DC-3 2 Curtiss C-46 Commando 1 Douglas DC-4 1 Fairchild C-82 Packet *On order:* 1 Fairchild C-28 Packet	3,520	600,000	62,141	27,843	10,092,064	State-owned.
HAITI								
Compagnie Haitienne de Transport Aérien (COHATA)	Port au Prince	Boeing Stratoliner Douglas DC-3	869	—	—	—	—	This new company has taken over the domestic services operated formerly under the control of the Air Corps.
HAWAIIAN ISLANDS								
Hawaiian Airlines, Ltd.	Honolulu International Airport, P.O. Box 3287, Honolulu 1. President: A. D. Lewis	5 Convair 340 8 Douglas DC-3	402	2,905,730 *48,878*	417,980 *10,306*	582,431	18,854,295 *65,678*	—
Trans-Pacific Airlines, Ltd. (T.P.A. Aloha Airline)	P.O. Box 3769, Honolulu President: R. F. Tongg Exec. Vice-Pres: D. A. Benz Ops. Manager: O. V. Andrew	8 Douglas DC-3	1,007	1,743,252 *11,826*	206,624 *2,485*	219,637	1,881,776	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
HONDURAS								
Servicio Aereo de Honduras S.A. (SAHSA)	Avenida Colon 4a. Calle, Tegucigalpa, D.C. President: R. Zelaya R. Vice-President: J. Octavio Duron	6 Douglas DC-3	2,644	791,631 *9,615*	47,722 *4,951*	514,306 *21,429*	8,335,801 *2,052,825*	—
TACA de Honduras	Tegucigalpa, D.C. President: A. Rodriguez	Douglas DC-3's	—	—	—	—	—	Subsidiary of Servicio Aereo de Honduras, S.A.; but operates as separate company.
Transportes Aéreos Nacionales S.A. (T.A.N.)	Edificio Marichal, Tegucigalpa, D.C. President: Miguel Brooks	3 Curtiss C-46 (Passengers) 3 Curtiss C-46 (Freight)	4,890	1,954,732 (inc. non-scheduled)	18,807	16,642	5,982,797 (inc. non-scheduled)	—
HONG KONG								
Cathay Pacific Airways, Ltd.	1 Connaught Road, Central, Hong Kong Chairman: J. A. Blackwood Man. Director: W. C. G. Knowles	1 Douglas DC-3 1 Douglas DC-4 1 Douglas DC-6 *On order:* 1 Douglas DC-6B	9,566	1,494,241 *182,350*	43,322 *1,966*	249,103	1,203,954	—
Hong Kong Airways Ltd.	Alexandra House, Hong Kong Chairman: H. D. M. Barton	Douglas DC-4 Douglas DC-6B *On order:* 2 Vickers Viscount	550	171,600	8,359	1,024,430	1,121,606	Aircraft chartered from other opertor.
HUNGARY								
Magyar Légikozlekedési Vállalet (Hungarian Air Transport—MALÉV)	Vörösmarty tér 5, Budapest V.	10 Li-2	1,848	—	—	—	—	State-owned.
ICELAND								
Flugfélag Islands H.F. (Icelandair)	Reykjavik Airport, Iceland Gen. Manager: Orn O. Johnson	2 Douglas DC-4 4 Douglas DC-3 2 Convair Catalina 1 Grumman Goose *On order:* 2 Vickers Viscount 759	4,567	1,332,472	67,262	373,101	3,290,816	—
Loftleidir H. F. (Icelandic Airlines)	Reykjanesbraut 6, Reykjavik Chairman: K. Gudlaugsson Gen. Manager: A. Elíasson	4 Douglas DC-4 (1 on charter) *On order:* 2 Lockheed Electra	5,711	1,932,522	21,773	70,985	513,447	—
INDIA								
Air-India International Corporation	New India Assurance Building, Majatma Gandhi Road, Fort, Bombay—1. Chairman: J. R. D. Tata Vice-Chairman and General Manager: B. R. Patel Technical Director: A. C. Gazdar	6 Lockheed Super Constellation 3 Lockheed L-749A Constellation *On order:* 2 Lockheed L-1049G Super Constellation 3 Boeing 707-320	18,886	5,163,261	62,079	974,848	2,771,967	State-owned.
Indian Airlines Corporation	Thapar House, Janpath, New Delhi Chairman: Shankar Prasad, I.C.S. Ops. Manager: Capt. J. A. Chitambar	6 Douglas DC-4 65 Douglas DC-3 12 Vickers Viking 8 D.H. Heron *On order:* 10 Vickers Viscount	23,600	17,758,210 *1,540,409*	485,156 *68,179*	11,429,787 *64,201*	93,219,445 *3,556,651*	A nationalised company formed on Aug. 1 1953, by merging of all Indian domestic carriers.
INDO-CHINA								
Air Laos	Vientiane	Boeing Stratoliner Douglas DC-3 Bristol Freighter	—	—	—	—	—	Formed in 1952 by Air France (30%), Aigle Azur (20%) and local interests. Operates internally and to Saigon, Bangkok and Hong Kong.
INDONESIA								
Garuda Indonesian Airways, N.V.	Djalan Nusantara 15, Djakarta President: Dr. M. Soetoto	8 Convair 340 8 Convair 240 20 Douglas DC-3	20,505	8,521,992 *429,302*	443,163 *3,121*	5,846,908	23,482,759	State-owned from March, 1954.
IRAN								
Iranian Airways Co.	Avenue Saadi, Teheran Man. Director: Reza Afshar Ops. Manager: Capt. W. R. Kyse	2 Convair 240 2 Douglas DC-4 7 Douglas DC-3 2 D.H. Dove 4 D.H. Rapide 1 Beechcraft C-18S *On order:* 3 Vickers Viscount	8,876	1,857,390 (inc. non-scheduled)	58,598 *1,059*	175,232	2,376,473 *182,739*	Under 5-year management contract with Transocean Air Lines, Oakland, California.
Persian Air Services (P.A.S.)	Ferdowsi Avenue 486 Teheran, Iran A. Chafik J. P. Lee Warner	2 Avro York	10,800	428,400	1,925	—	2,898,600	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
IRAQ								
Iraqi Airways	New Railway Station Building, Baghdad West Manager: Kanaan Al Askari	3 Vickers Viscount 735 3 Vickers Viking 1 D.H. Dove *On order:* 2 Vickers Viscount 773	2,950	1,106,415 *207,707*	53,684 *3,263*	111,946	705,989	State-owned.
IRELAND								
Aer Lingus, Teoranta	43, Upper O'Connell Street, Dublin Chairman: P. Lynch Gen. Manager: J. F. Dempsey	4 Vickers Viscount 707 13 Douglas DC-3 *On order:* 3 Vickers Viscount 808 7 Fokker Friendship	3,970	3,788,725 *298,225*	439,437 *9,358*	3,498,871 *213*	10,137,057 *2,535,564*	Aer Rianta has 90% interest on behalf of Irish Government. B.E.A. holds remaining 10%
ISRAEL								
El Al Israeli Airlines Ltd.	76, Maze St., Tel Aviv Managing Director: General E. Ben-Arzi	4 Lockheed Constellation *On order:* 3 Bristol Britannia 313	26,316	2,529,736 *105,654*	36,671 *3,809*	291,532	1,280,417	State owns 63% and Public Institutions 37%. Has 50% interest in "Arkia."
Israel Inland Airlines Ltd. (ARKIA)	70, Ahad Ha'am Street, Tel Aviv Man. Director: J. Hozmann Technical Manager: K. Eisinger	2 Douglas DC-3	186	181,192 *17,957*	23,121	12,540	78,568	—
ITALY								
Aerolinee Italiane Internazionali (ALITALIA)	20 Via L. Bissolati, Rome Chairman: Count Dr. Nicoló Carandini Gen. Manager: Ing. Bruno Velani	6 Douglas DC-6B 4 Convair 340 *On order:* 4 Douglas DC-7C 2 Convair 440	30,217	5,050,052	116,843	873,306	3,279,946	At time of writing plans were being finalised for the merging of Alitalia and LAI under the name Alitalia-Linee Aeree Italiane.
Linee Aeree Italiane S.p.A. (L.A.I.)	5, Via San Nicolò da Tolentino, Rome President: General Aldo Urbani Comm. Manager: Dr. Riccardo Naselli	3 Douglas DC-6B 3 Douglas DC-6 13 Douglas DC-3 6 Vickers Viscount 785 *On order:* 4 Vickers Viscount 4 Lockheed L-1649A Starliner	22,052	6,450,392	277,808	2,726,891	6,005,936	Due to be merged with Alitalia to form a new Company to be known as Alitalia-Linee Aeree Italiane.
JAPAN								
Far Eastern Airlines Co., Ltd.	Osaka Building, No. 1, Soze-cho, Kita-Ku, Osaka President: W. Kanno Gen. Manager: Adl. T. Nakamura	3 Auster J5G Autocar 2 D.H. Dove 2 Handley Page Marathon 2 Douglas DC-3C *On order:* 3 Douglas DC-3C	—	1,361,471.2 *96,621.2*	44,588 *1,494*	80,621.86	73,743.56	—
Japan Air Lines Company Ltd. (J.A.L.)	Tokyo Building, 2-chome, Marunouchi, Chiyodaku, Tokyo President: Seijiro Yanagita Vice-President: Kambu Ishikawa	5 Douglas DC-6B 9 Douglas DC-4 3 D.H. Heron 1 Beechcraft D-18S *On order:* 4 Douglas DC-8 4 Douglas DC-7C	11,920	6,459,287 *143,737*	366,765 *900*	2,473,902 *8,644*	4,181,635 *33,878*	—
JORDAN								
Air Jordan Co. Ltd.	P.O. Box 274, Amman Executive Director: R. M. Stanley	3 Douglas DC-3 1 D.H. Rapide 1 Curtiss C-46F Commando	—	488,939 *123,684*	28,948 *2,971*	30,365	1,173,285	—
Arab Airways (Jerusalem) Ltd.	King Hussein Street, Amman Manager: Wadi Salameh	3 Douglas DC-3	3,092	520,100 *97,083*	22,164 *2,916*	73,825 *15*	538,606 *22,555*	The National Airline of Jordan. In association with B.O.A.C.
KOREA (North)								
Ukamps	Pyongyang, Korean Democratic Republic	Li-2	—	—	—	—	—	Successor to Soviet-Korean airline Sokao. Operates between Pyongyang and Mukden and Chita.
KOREA (South)								
Korean National Airlines	No. 1 First Street, Chyong-No District, Seoul President: Y. W. Shinn Ops. Director: J. H. Taylor	3 Douglas DC-3 2 Douglas DC-4	—	—	—	—	—	State-owned.
KUWAIT								
Kuwait Airways Ltd.	Kuwait Chairman: A. S. Alkhalid Manager: A. R. Mishri	2 Douglas DC-3	—	—	—	—	—	Founded in 1953, originally as Kuwait National Airways. An associate of B.O.A.C.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
LEBANON								
Air Liban	Place Riad Solh, Esseily Building, Beirut Director General: Henry Naccache	2 Douglas DC-4 3 Douglas DC-3 1 Languedoc 161 *On order:* 2 Douglas DC-6	9,501	1,513,247 *168,873*	48,071 *3,155*	69,386 *818*	3,112,818 *94,739*	Air France has 38% interest.
Lebanese International Airways	Beirut President: A. Arida	2 Lockheed L-1049 Super Constellation	—	—	—	—	—	Seaboard Western Airlines have 30% ownership and have supplied aircraft. Two additional Super Constellations will be added later for service expansion. Transatlantic service Beirut-New-York (via Milan, Paris, London) planned to open mid-1957. Extension to Mexico City planned.
Middle East Airlines Co. S.A. (MEA)	Abdul Aziz Street, P.O. Box 206, Beirut Chairman and Man. Director: Sheikh Najib Alamuddin Gen. Manager: Col. Cyril Essely	4 Douglas DC-3 3 Vickers Viscount 1 Bristol Wayfarer 170 *On order:* 2 Vickers Viscount	11,138	1,941,166 *272,330*	55,752 *4,743*	154,776 *2,698*	1,293,681 *232,129*	—
Trans-Mediterranean Airways (TMA)	Beirut	5 Avro York	—	—	—	—	—	Cargo Charter company. Freighting contracts with Iraq Petroleum Co. and Aramco.
LIBERIA								
Liberian National Airways	Roberts Field, Liberia, West Africa General Manager: Frederick H. Syphert	2 Douglas DC-3	1,932	159,409 *33,542*	17,089 *1,954*	n.a.	524,895 *125,735*	—
MADAGASCAR								
S.A. Air Madagascar	Rue Général Roques, Tananarive Chairman: Général Fayet Gen. Manager: M. Vernier	1 Douglas DC-3 6 D.H. 89 Rapide 2 Cessna 170 *On order:* 1 Douglas DC-3	5,294	430,789 *103,377*	8,146	159,860	468,702	—
MALAYA								
Federation Air Service (Malaya) (F.A.S.)	Malayan Railways, Kuala Lumpur Chairman and Deputy Manager: D. D. Bartlett	5 D.H. Beaver	692	221,375 *99,375*	3,037 *874*	20,405	31,865	Government-owned Managed on behalf of the Dept. of Civil Aviation by the Malayan Railway Administration.
Malayan Airways Ltd.	Ocean Building, Collyer Quay, Singapore 1. Man. Director: Capt. R. P. Mollard Manager: J. Skelton	11 Douglas DC-3 3 D.H. Rapide	4,856	3,152,416 *168,288*	155,471 *1,109*	1,309,204 (inc. non-scheduled)	8,484,593 (inc. non-scheduled)	Sabah Airways Ltd. is a fully-owned subsidiary. An associate of B.O.A.C.
MALTA								
The Malta Airlines	285, Kingsway, Valletta. Chairman: Lt. Col. R. G. Strickland Gen. Manager: J. T. Crossey	—	—	—	—	—	—	Incorporates Malta Airways Co. Ltd. and Air Malta Co. Ltd. Services operated by B.E.A.
MEXICO								
Aerolineas Mexicanas S.A.	Boulevard Aeropuerto Central No. 161, Mexico, D.F. Gen. Manager: Lic. Ruben Ruiz Alcantraaa	Douglas DC-3	—	—	—	—	—	Has taken over Aerovias Reforma S.A.
Aeronaves de Mexico S.A. (AMSA)	Mariano Escobedo 543, Mexico, D.F. President: Antonio Díaz Lombardo Gen. Manager: Carlos Ramos	4 Convair 340 3 Douglas DC-4 14 Douglas DC-3 *On order:* 2 Bristol Britannia	7,552	6,999,028 (inc. non-scheduled)	391,101 (inc. non-scheduled)	708,258	8,631,046 (inc. non-scheduled)	Pan American World Airways has a 13.65% interest.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
MEXICO—*cont.*								
Aero-Transportes S.A. (A.T.S.A.)	Ave. Juarez No. 117-A, Mexico, D.F. President: R. O'Farrill Gen. Manager: H. J. Filshinger	Douglas DC-3	192	—	—	—	—	Operates in conjunction with Compañiá Mexicana de Aviación S.A. from which aircraft are leased. Combines the resources of Aerovias Latino-Americanos S.A., Aerovias Transcontinentales S.A. and Transportes Aereos de Jalisco S.A.
Compañiá Mexicana de Aviación S.A. (Mexicana)	Balderas 36, Mexico City President: A. Saenz Gen. Manager: E. R. Silliman	4 Douglas DC-7C 4 Douglas DC-6 6 Douglas DC-4 15 Douglas DC-3 4 Douglas C-47 3 Fairchild C-82	5,734	13,561,047	553,168	1,664,224	39,234,260	Pan American World Airways holds a 41.86% interest.
Guest Aerovias Mexico, S.A.	Reforma 95, Mexico City President: Winston Guest Vice-President and Gen. Manager: G. L. Monteiro Ops. Manager: R. H. Walroth	2 Lockheed L-749 Constellation 1 Douglas DC-4 2 Fairchild C-82	4,770	1,541,912 *241,751*	36,751 *479*	71,993	715,495	—
Trans Mar de Cortes S.A.	Calle Esquerro No. 50, La Paz, Baja California Man. Director: Mayo Obregon T. Gen. Manager: Luis Coppola B.	3 Douglas DC-3C	5,306	657,192 *188,946*	22,873 *5,448*	569,256 *13,958*	789,838 *76,037*	—
Transportes Aereos Mexicanos S.A. (T.A.M.S.A.)	Calle 6 No. 518, Mérida, Yucatán President: Arturo P.G. Cantón Gen. Manager: J. V. Hernández	1 Douglas DC-3 1 Douglas C-47 1 Consolidated Vultee B-24J 3 Fairchild C-82A	1,029	710,103	11,748	267,191	10,748,623	—
MOROCCO								
Compagnie Nationale Royale Air Maroc	65, Avenue de l' Armée Royale, Casablanca Director Général: M. A. Faurous	4 Douglas DC-4 4 Douglas DC-3	27,360	1,959,604 *214,582*	126,177 *10,167*	1,141,914 *8,386*	2,265,448 *339,653*	Formerly known as Compagnie Chérifienne de Transports Aériens "Air Atlas/Air Maroc" and owned equally by Air France, the Moroccan Government and the Paquet and Fraissinet Shipping Group.
NETHERLANDS								
Koninklijke Luchtvaart Maatschappij N.V. (K.L.M. Royal Dutch Airlines)	Plesmanweg 1, The Hague President: I. A. Aler Deputy President: M. J. van der Ploeg	10 Lockheed L-1049G Super Constellation 8 Lockheed L-1049E Super Constellation 10 Lockheed L-749A Constellation 6 Douglas DC-6 8 Douglas DC-6A/B 6 Douglas DC-4/C-54 14 Convair 340 7 Convair 240 14 Douglas DC-3/C-47A (of which 3 chartered to De Kroonduif) *On order:* 8 Douglas DC-8 10 Douglas DC-7C 12 Lockheed Electra 9 Vickers Viscount 800 2 Fokker F.27 Friendship	158,500	37,500,000 *1,900,000*	792,000 *30,000*	5,791,000 *7,000*	50,906,000 *1,429,000*	State holds 96% interest.
NETHERLANDS ANTILLES								
Koninklijke Luchtvaart Maatschappij N.V. (K.L.M. Royal Dutch Airlines, Caribbean Division)	Curaçao, Netherlands Antilles Gen. Manager: C. C. Steensma	4 Convair 340 4 Douglas DC-3	7,570	2,009,822 *109,423*	106,100 *4,750*	9,629,780 *149,914*	716,061 *2,866*	—
NETHERLANDS NEW GUINEA								
Nederlands Nieuw Guinea Luchtvaartmaatschappij "De Kroonduif" N.V.	Plesmanweg 1, The Hague, Netherlands Management conducted by K.L.M.	3 Douglas DC-3 4 D.H. Beaver *On order:* 3 Scottish Aviation Twin Pioneer	2,000	364,600 *23,700*	17,100 *900*	164,900 *1,300*	789,400 *93,100*	Managed by K.L.M. from which DC-3's are chartered.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
NEW CALEDONIA								
Société Calédonienne de Transports Aériens "TRANSPAC"	Rue du Général Galliéni, Noumea President: H. G. Martinet Manager: H. C. Coursin	3 D.H. 89 Rapide	790	112,405	5,885 *127*	9,693	41,922	—
NEW GUINEA								
Gibbes Sepik Airways, Ltd.	Goroka, T.N.G. Man. Director: R. H. Gibbes, D.S.O., D.F.C. Gen. Manager: V. W. Cox	5 Noorduyn Norseman 3 Junkers Ju52 *On order:* 2 Cessna 180	5,546	453,000 (inc. non-scheduled)	15,525 (inc. non-scheduled)	140,239 (inc. non-scheduled)	6,230,750 (inc. non-scheduled)	—
Mandated Airlines, Ltd.	Lae Man. Director: J. B. Sedgers Manager: H. J. Hindwood	2 Douglas DC-3 3 D.H. 84 Dragon *On order:* 1 Douglas DC-3	1,773	—	27,683	241,152	6,585,150	Data for year ending March 31, 1956
NEW ZEALAND								
New Zealand National Airways Corporation (N.Z.N.A.C.)	P.O. Box 96, Aotea Quay, Wellington Chairman: Sir Leonard M. Isitt, K.B.E. Gen. Manager: J. J. Busch, O.B.E. Ops. Manager: H. E. Walker, M.V.D., A.F.C.	25 Douglas DC-3 4 D.H. Heron 3 D.H. Rapide *On order:* 3 Vickers Viscount 807	3,679	6,745,908 *241,951*	469,616 *5,373*	1,208,636	18,089,506	—
Tasman Empire Airways Ltd. (TEAL)	Airways House, Customs Street, Auckland Chairman: Sir Leonard M. Isitt, K.B.E. Gen. Manager: G. N. Roberts	3 Douglas DC-6 2 Short Solent	10,000	1,973,928	54,036	599,767	661,047	Jointly owned by Governments of New Zealand (50%) and Australia (50%).
Trans Island Airways, Ltd.	Oamaru Secretary: K. T. Cusack	1 D.H.89 Rapide 2 Beechcraft D-18S	—	—	—	—	—	Formed in 1956 for domestic services in New Zealand and for services to Rongotai and Chatham Islands.
NICARAGUA								
Lineas Aereas de Nicaragua, S.A. (La Nica)	Managua President: Ing. Luis A. Somoza Vice-President and Treasurer: Col. Camilo Gonzalez C.	6 Douglas C-47 2 Curtiss C-46 Commando 1 Beechcraft C-45	1,857	310,960 *523,267*	20,760 *2,127*	79,831 *1,079*	6,976,528 *19,549,013*	Pan American World Airways holds a 20% interest. Nicaraguan Government has a 10% interest.
NORWAY								
Braathen's South American and Far East Air Transport A/S. (S.A.F.E.)	Fr. Nansenspl. 7, Oslo President: Ludv. G. Braathen Vice-President: Bjorn G. Braathen Ops. Manager: J. Raad	2 Douglas DC-4 2 Douglas DC-3 3 D.H. Heron *On order:* 3 Fokker F-27 Friendship	916	871,549 42,411	47,248 *1,836*	210,270	394,310 *8,252*	Two Douglas DC-4 on charter to Icelandic Airlines (Loftleidir), Reykjavik.
Det Norske Luftfartselskap A/S. (D.N.L.)	Oslo Chairman: Per M. Hansson President: O. Steen	—	—	—	—	—	—	A non-operating holding company in the SAS Consortium. See under "Scandinavia."
Vestlandske Luftfartselskap A/S. (West Norway Airlines)	Bergen President: J. Horn Director: S. Liby	1 D.H. Heron Series 2 2 Short Sealand 1 Republic Seabee	856	275,913 *1,642*	11,141	5,678,369 ton-miles	906.116 ton-miles	—
Wideroe's Flyveselskap og Polarfly A/S.	Kr. Augustgt. 19, Oslo Gen. Manager: Viggo Widerõe	4 D.H. Otter 6 Noorduyn Norseman 2 Lockheed 12 12 other aircraft	1,544	270,100 *279,440*	11,640 *1,908*	228,635	37,775	—
PAKISTAN								
Pakistan International Airlines Corporation (P.I.A.)	Central Hotel Building, M.A. Khuro Road, Karachi Gen. Manager: Zafarul Ahsan Flight Ops. Manager: Capt. M. M. Haq	3 Lockheed L-1049C Super Constellation 4 Convair 240 11 Douglas DC-3 *On order:* 3 Vickers Viscount 815 2 Lockheed L-1049H Super Constellation	—	3,496,960	133,071	369,695 ton-miles	2,061.786 ton-miles	State-owned
PANAMA								
Compania Panamena de Aviacion S.A. (C.O.P.A.)	Avenida Peru 25, Panama, R.P. President: Ricardo Arias, Jr.	6 Douglas DC-3	542	—	—	—	—	Pan American World Airways has a 33% interest

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
PERU								
Compañia de Aviacion Faucett S.A.	Jirón Unión 926, Hotel Bolivar, Lima President: E. Dibós D. Man. Director: A. Bentín M.	3 Douglas DC-4 7 Douglas DC-3 4 Faucett-Stinson *On order:* 1 Douglas DC-4B	5,267	2,831,606	146,048	1,132,290	28,833,624	—
PHILIPPINES								
Philippine Air Lines, Inc. (P.A.L.)	M.R.S. Building, Plaza Cervantes, Manila President: Col. A. Soriano Ops. Manager: Renato Barretto	25 Douglas DC-3 1 Convair 340 3 D.H. Otter 2 Hiller UH-12B *On order:* 2 Vickers Viscount 784	—	4,796,000 *824,000*	364,817	109,163 ton-miles	1,896,155 ton-miles	Operates internally and to Hong Kong.
POLAND								
Polskie Linie Lotnicze "LOT"	Ul Hoza 39, Warsaw Director General: Al Skala Director (Ops.): M. Grabowski	Ilyushin Il-14 Ilyushin Il-12 Li-2 Douglas DC-3 Aero 45	6,318	3,487,740 *113,648*	191,042 *6,608*	1,035,074	3,431,198	LOT's activities include scheduled air services, charter flights, crop and forest dusting and other work.
PORTUGAL								
Transportes Aéreos Portugueses, S.A.R.L. (T.A.P.)	Rua Braamcamp No. 2, Lisbon Chairman: D. Francisco de Mello e Castro Ops. Manager: Roger de Avelar	6 Douglas DC-3 3 Douglas DC-4 3 Lockheed L-1049G Super Constellation	17,576	2,131,930 *12,054*	42,341	552,672 ton-miles	398,631 ton-miles	Formerly state-owned. Became a private company June 1, 1953.
PORTUGUESE AZORES								
Sociedade Açoriana de Transportes Aéreos, Ltda. (SATA)	Rua dos Mercadores 7, Ponta Delgada, S. Miguel Bensaúde & Co. Ltd.	2 D.H. Dove	423	140,632 *2,181*	7,321	6,472.80 ton-miles	5,901.11 ton-miles	Operates inter-island services.
PORTUGUESE EAST AFRICA								
Divisão de Exploração dos Transportes Aéreos (DETA)	103, Rua Araujo, P.O. Box 276, Lourenço Marques, Mozambique Dir. General: A. P. Pereira Leite Gen. Manager: A. H. Pinho da Cunha	3 Douglas DC-3 3 Lockheed Lodestar 6 D.H. Dove 2 Junkers Ju52/3m 4 D.H. 89 Rapide 1 D.H. 90 Dragonfly 2 D.H. 87 Hornet Moth	2,569	1,232,000 *52,800*	21,707	51,111 ton-miles	155,857 ton-miles	Organised by Colonial Government of Mozambique in 1936 as Division of the Dept. of Railways, Harbours and Airways
PORTUGUESE INDIA								
Transportes Aéreos da India Portuguesa	Goa Director: Maj. A. G. Solano d'Almeida	2 D.H. Heron Series 2 2 Vickers Viking	—	2,323 ton-miles	2,885	59,095	13,574	—
PORTUGUESE TIMOR								
Transportes Aéreos de Timor (T.A.T.)	Dili Airport, Timor Manager: F. L. V. A. Cardosa Dias	2 D.H. Dove	560	—	—	—	—	State-owned.
PORTUGUESE WEST AFRICA								
Divisão de Exploração dos Transportes Aéreos (D.T.A.)	Rua Pereira Forjaz, P.O. Box 79, Luanda, Angola President: R. Serrão Man. Director: Maj. J. da Silva Medina	5 Douglas DC-3 4 Beechcraft D-18S 7 D.H. 89 Rapide	4,350	1,155,000 *50,950*	31,064	39,753 ton-miles	122,414 ton-miles	Formed in 1938 as Division of the Ports, Railways and Transport Administration.
Serviço de Transportes Aéreos (S.T.A.)	Aeroporto Salazar, S. Tomé Gen. Manager: V. C. Cortes	1 Tiger Moth 1 Piper Super Cruiser 1 Auster Autocar 3 D.H. Rapide	268	24,650	738	1,678	7,440	—
PUERTO RICO								
Caribbean Atlantic Airlines, Inc. (Caribair)	San Juan, Puerto Rico President: Dionisio Trigo Vice-President: Benigno Trigo	4 Douglas DC-3	462	823,522 *36,612*	177,795 *4,289*	447,760	824,000 *454,000*	—
RUMANIA								
Transporturi Aeriene Romine (TAROM)	Aeroportul Baneasa, Bucharest Manager: Ing. Stingaciu Vladimir Asst. Manager: Vaduva Gheorghe	Ilyushin Il-14 Ilyushin Il-12 Li-2	Approx. 5,000	—	—	—	—	State-owned.
SAUDI ARABIA								
Saudi Arabian Airlines	Jedda Tech. Manager: W. E. Blankenship Ops. Supt.: S. H. Wheatley	4 Convair 340 5 Douglas DC-4 13 Douglas DC-3 5 Bristol Wayfarer Sikorsky S-55 *On order:* 6 Convair 340	Approx 4,500	—	—	—	—	Government owned. Managed by T.W.A. Traffic kept by Government and not published.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
SCANDINAVIA								
Scandinavian Airlines System (SAS)	Bromma Airport, Stockholm 40, Sweden President: H. Throne-Holst	6 Douglas DC-7C 14 Douglas DC-6B 12 Douglas DC-6 11 Convair 440 4 Douglas DC-4 10 Douglas DC-3 8 Saab Scandia *On order:* 7 Douglas DC-8 8 Douglas DC-7C 5 Convair 440	84,181	29,280,651 *599,846*	1,212,526 *16,645*	10,987,147	25,094,160	A consortium consisting of the national airlines of Denmark (DDL), Norway (DNL) and Sweden (ABA).
SOUTH AFRICA								
Commercial Air Services (Pty.) Ltd. (Comair)	Seventh Floor, Balgownie House, Commissioner Street, Johannesburg Directors: J. M. S. Martin M. Geffen L. Zimmerman, M. D. N. Wyatt, A. C. Joubert	3 Lockheed Lodestar 2 Cessna 180	450	213,275 *111,768*	8,458 *257*	9,439	581,790 *183,572*	Associated Company of Airwork Ltd., London.
South African Airways (S.A.A.)	Jan Smuts Airport, Kempton Park, Transvaal Chief Airways Manager: Col. J. D. T. Louw	3 Douglas DC-7B 5 Lockheed Constellation 7 Douglas DC-4 6 Douglas DC-3 *On order:* 7 Vickers Viscount 813	31,810	6,837,344 *190,263*	267,288 *1,366*	2,949,142 *334*	3,351,864 *2,504*	State-owned.
SOUTH WEST AFRICA								
South West Air Transport (Pty.) Ltd.	Windhoek Chairman: P. H. M. Du Plessis Manager: G. T. van Rooyen	6 Ryan Navion 1 D.H. Rapide	—	—	—	—	—	Operates feeder services to connect with S.A.A. flights at Windhoek.
SOVIET UNION								
Aeroflot-Grazdanskij Wozdusnyj Flot (Aeroflot)	Hotel Metropol, Sverdlov Square, Moscow Div. General: Marshal P. F. Zhigarev Deputy Dir. General: Lt. Gen. N. A. Zakharov	Tu-104 Il-14 Il-12 Il-20 Li-2 An-2 Po-2 Yak-12R Yak-16	Approx 230,000	—	Approx. 4,000,000	—	—	Total fleet strength is said to be more than 400 aircraft.
SPAIN								
Aviacion y Comercio, S.A. (Aviaco)	Aduana 33, Madrid Chairman and Man. Director: Jose Pazo Montes	4 S.O. 161 Languedoc 6 Bristol Freighter *On order:* 8 D.H. Heron Series 2	6,765	2,121,631	222,284	290,164 ton-miles	188,432 ton-miles	—
Compañia Mercantil Anónima de Lineas Aéreas Españolas (IBERIA)	Avenida de América, 2, Madrid President: Tomás Delgado Gen. Manager: César G. Lucía Ops. Supt.: José Ansaldo	3 Lockheed Super Constellation 6 Douglas DC-4 17 Douglas DC-3 4 Bristol Freighter *On order:* 2 Lockheed L-1049G Super Constellation 5 Convair 440	42,897	9,901,315 *62,651*	673,343 *133*	1,918,020	3,507,551	—
SUDAN								
Sudan Airways	Gaon Building, P.O. Box 253, Sirdar Avenue, Khartoum Gen. Manager: Abdel Bagi Mohamed Ops. Manager: D. W. Graham	4 D.H. Dove 4 Douglas DC-3 *On order:* 1 Douglas DC-3	5,295	1,012,853 *148,917*	22,216 *3,652*	100,467 *2,789*	899,115 *37,892*	A department of the Sudan Government.
SWEDEN								
Aero-Nord Sweden A.B.	Bromma Airport, Stockholm 40 Man. Director: P-S. Holmström	1 Aero Commander 2 Piper Cub 1 Airspeed Oxford *On order:* 1 Aero Commander 2 Piper Cub	—	—	—	—	—	Operates scheduled newspaper and passenger services.
Airtaco A.B.	Bromma Airport, Stockholm Man. Director: C.-H. Hoeljfors	3 Douglas DC-3 4 Lockheed Lodestar 1 Lockheed 12A	—	— *1,280,830*	— *21,990*	—	— *9,435,884*	Operates newspaper, passenger, charter and ambulance services.
Aktiebolaget Aerotransport (A.B.A.)	Bromma Airport, Stockholm 40 Chairman: Axel Gjöres President: Karl Lignell	—	—	—	—	—	—	A non-operating company in the SAS consortium. See under "Scandinavia".

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
SWEDEN—*cont.*								
Ostermans Aero A.B.	Stockholm Man. President: N. Billing	2 Sikorsky S-55 9 Bell 47 4 Republic Seabee 1 Noorduyn Norseman *On order:* 1 Bell 47 J 1 S.O. 1221 Djinn	—	310,685	—	57,320	—	Operates scheduled winter mail service throughout Stockholm Archipelago and year-round non-scheduled flights.
Transair Sweden AB	Bromma Airport, Stockholm 40 President: P. Lovèn Ops. Manager:) Count C. G. v. Rosen	2 Douglas DC-3 3 Curtiss C-46	—	284,516 *357,650*	25,879 *7,607*	52,077 *188,622*	544,373 *144,482*	—
SWITZERLAND								
Swiss Air Transport Company, Ltd. (Swissair)	Hirschengraben 84, Zurich President: Dr. W. Berchtold	2 Douglas DC-7C 6 Douglas DC-6B 3 Douglas DC-4 9 Douglas DC-3 7 Convair 440 2 Convair 240 *On order:* 3 Douglas DC-8 2 Douglas DC-7C 4 Convair 440	36,102	13,478,995 *234,675*	766,663 *7,293*	7,950,614 *4,416*	22,348,392 *627,047*	State holds 30% interest. Swissair Photo Ltd. is a wholly-owned subsidiary.
SYRIA								
Syrian Airways	Fardoss Street, Damascus Gen. Manager: N. Baker	Douglas DC-4 Douglas DC-3	—	—	—	—	—	—
TAHITI								
Régie Aérienne Interinsulaire	Papeete	1 Consolidated PBY Catalina	—	46,695 ton-miles	2,760	1,160	26,727	Operates from Tahiti to other islands in the Society Group.
TAIWAN (FORMOSA)								
Civil Air Transport (C.A.T.)	46, Chung Shan Road, North 2nd Section, Taipei Chairman: Wang Wensan Man. Director: H. L. Grundy	2 Douglas DC-4 23 Curtiss C-46 5 Douglas DC-3 2 Convair Catalina	6,762	1,411,000 *1,556,000*	54,198	236,625 ton-miles	930,094 ton-miles	—
Foshing Airlines	30, Shinn Yang Street, Taipei Chairman: Moon F. Chin President: Ango Tai	1 Convair Catalina 1 Curtiss C-46 2 Douglas DC-3	536	278,880 *78,190*	49,256 *10,528*	73,000 *64,800*	573,000 *1,044,000*	—
THAILAND								
Thai Airways Company Ltd. (T.A.C.)	6, Larn Luang Road, Bangkok Chief Exec. Director: Sphrang Devahastin Man. Director: Sakol Rasanandra	2 Douglas DC-4 5 Douglas DC-3 2 Noorduyn Norseman *On order:* 3 Lockheed L-1049G Super Constellation	7,635	2,107,731 *46,391*	82,561 *2,291*	569,200 *400*	1,536,200 *67,200*	Government hold 95% of capital.
TUNISIA								
Société Tunisienne de l'Air (Tunis Air)	1 Rue d'Athènes, Tunis Gen. Manager: P. F. Delaunay	2 Douglas DC-4 3 Douglas DC-3	6,404	1,249,447	112,556	549,832	1,383,391	Air France and Tunisian Government respectively hold 51 and 49% of capital.
TURKEY								
Turk Hava Yollari, Anonim Ortakligi (Turkish Airlines Inc.) (T.H.Y.)	Idare Merkezi, Ankara Gen. Manager: H. Unsal Ops. Director: S. Iscen	21 Douglas DC-3 7 D.H. Heron	4,672	3,335,000 *5,590*	201,700	61,207 ton-miles	214,540 ton-miles	—
URUGUAY								
Compãnia Aeronautica Uruguaya S.A. (Causa)	Calle Colonia 1068, Montevideo President: J. Americo Beisso Man. Director: Col. Tydeo L. Borges	3 Short Sandringham	154	—	—	—	—	—
Primeras Líneas Uruguayas de Navegación Aérea (PLUNA)	Avd. Agracidad y Colonia, Montevideo President: Col. Eusebio B. Vaeza Vice-President: J. L. Rossi Laures	6 Douglas DC-3 4 D.H. Heron *On order:* 3 Vickers Viscount 769	11,750	1,539,951 *37,809*	—	18,376	407,215	Government-owned since 1951.
U.S.A.								
Aaxico Airlines, Inc.	Miami, Florida President and Gen. Manager: H. J. Korth	3 Curtiss C-46F	—	—	—	10,377	469,511	Formerly known as American Air Export and Import Company. All-cargo operator with scheduled services between New York, New Orleans and Detroit.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
U.S.A.—*cont.*								
Aerovias Sud Americana, Inc. (ASA International Airlines)	Pinellas International Airport, St. Petersburg, Florida President and Gen. Manager: V. V. Carmichael, Jr. Vice-President-Washington Counsel: C. Booker Powell	4 Curtiss C-46F	2,650	8,048,000 ton-miles	—	—	14,747,634	Operates a freight service to Belize, Bogota, El Salvador, Guatemala, Havana, Panama, Quito and Guayaquil, Ecuador.
Allegheny Airlines Inc.	Hangar 12, Washington National Airport, Washington 1, D.C. President: L. O. Barnes	15 Douglas DC-3 5 Martin 202 *On order:* 2 Martin 202	2,205	5,416,824 *44,051*	391,162 *2,506*	1,187,916	3,905,478	—
Alpena Flying Service, Inc.	Alpena County Airport, Alpena, Michigan President: Robert C. Welch Secretary: Coral J. Welch	2 Cessna 195 1 Piper Apache	400	45,000 *160,000*	400 *550*	—	2,000 *2,500*	—
American Airlines, Inc.	100 Park Avenue, New York 17, New York President: C. R. Smith Vice-President (Ops.) O. M. Mosier	74 Convair 82 Douglas DC-6 39 Douglas DC-7 2 Douglas DC-4 *On order:* 3 Douglas DC-6 19 Douglas DC-7 35 Lockheed Electra 30 Boeing 707	14,498	4,891,993,000 pass-miles *7,636,000* pass-miles	7,785,000 *8,000*	20,264,000 ton-miles	85,444,000 ton-miles *113,000* ton-miles	American Airlines de Mexico, S.A. is a wholly-owned subsidiary.
Avalon Air Transport, Inc.	Long Beach, California President: Wilton R. Probert	6 Grumman Goose	—	—	59,272	386,000	—	Operates amphibian services between Long Beach and Avalon, Catalina Island.
Bonanza Air Lines, Inc.	P.O. Box 391, Las Vegas, Nevada President: Edmund Converse Exec. Vice-Pres: G. Robert Henry Vice-President (Ops.): M. W. Reynolds	9 Douglas DC-3 *On order:* 3 Fairchild F-27	1,438	2,847,972 *88,287*	127,860 *4,344*	49,162 ton-miles	106,909 ton-miles	—
Braniff Airways, Inc.	P.O. Box 35001, Dallas 35, Texas President: C. E. Beard Chairman: F. Jones	4 Douglas DC-7C 9 Douglas DC-6 30 Convair 340 and 440 23 Douglas DC-3 2 Lockheed L-049 Constellation 2 Curtiss C-46 *On order:* 3 Douglas DC-7C 9 Lockheed Electra 5 Boeing 707	16,422	32,176,353 *221,451*	1,815,298 *5,375*	11,963,240	25,842,400	—
California Central Airlines, Inc.	Lockheed Air Terminal, Burbank, California. President: Col. C. C. Sherman	1 Douglas DC-3		—	—	—	—	—
Capital Airlines Inc.	Washington 1, D.C. President: J. H. Carmichael Vice-President (Ops.): J. B. Franklin	12 Lockheed Constellation 14 Douglas DC-4 21 Douglas DC-3 54 Vickers Viscount *On order:* 5 Vickers Viscount	7,085	39,792,366	2,984,410	3,257,633 ton-miles	5,823,783 ton-miles	—
Catalina Airlines	Beverly Hills, California	2 de Havilland Dove Douglas DC-3s	—	—	—	—	—	Operates scheduled services between Los Angeles and Catalina Island.
Central Airlines, Inc.	Meacham Field, Fort Worth, Texas President: Keith Kahle Exec. Vice-President: F. E. Howe	11 Douglas DC-3	3,299	2,762,175 *23,504*	107,119 *639*	491,140	978,500	—
Chicago Helicopter Airways, Inc.	5240, West 63rd Street, Chicago 38, Illinois President: J. S. Gleason, Jr. Exec. Vice-President C. W. Moore	6 Bell 47G 3 Sikorsky S-55 *On order:* 3 Sikorsky S-58	318	355,284 *23,336*	876	2,032,449		Operates mail and passenger helicopter service in Chicago area. Formerly known as Helicopter Air Service, Inc.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
U.S.A.—*cont.*								
Continental Air Lines, Inc.	Denver, Colorado President: Robert F. Six Exec. Vice-President: C. C. West, Jr. Vice President (Ops.): O. R. Haueter	15 Douglas DC-3 6 Convair 340 3 Convair 440 1 Douglas DC-6 4 Douglas DC-6B *On order:* 5 Douglas DC-7B 15 Vickers Viscount 810D 4 Boeing 707	6,051	13,439,415	707,938	459,380	7,622,000	Merged with Pioneer Air Lines, April 1, 1955.
Delta Air lines, Inc.	Atlanta Airport, Atlanta, Georgia. President and General Manager: C. E. Woolman Chairman: R. W. Freeman Vice President (Ops.): C. H. Dolson	11 Douglas DC-7 7 Douglas DC-6 14 Douglas DC-3 2 Douglas DC-3 (Freighter) 4 Lockheed Constellation 20 Convair 340 5 Convair 440 *On order:* 8 Douglas DC-8 10 Douglas DC-7 10 Convair 880 3 Convair 440	10,765	37,849,000	2,606,945	15,000,234	44,126,532	Merged with Chicago and Southern Airlines on May 1, 1953.
Eastern Air Lines, Inc.	Eastern Air Lines Building, 10 Rockefeller Plaza, New York 20, New York Chairman of the Board and Gen. Manager: Capt. E. V. Rickenbacker President: T. F. Armstrong	20 Douglas DC-7B 10 Lockheed L-1049G Super Constellation 16 Lockheed L-1049C Super Constellation 13 Lockheed L-1049 Super Constellation 18 Lockheed L-749 Constellation 59 Martin 404 5 Douglas DC-4 7 Douglas DC-3 1 Douglas C-54 16 leased and operating, but not owned *On order:* 20 Convair 440 30 Douglas DC-7B 40 Lockheed Electra 20 Douglas DC-8	16,708	114,869,528	7,661,536	30,754,390	58,396,363	Absorbed Colonial Airlines, Inc. effective June 1, 1956.
The Flying Tiger Line Inc.	Lockheed Air Terminal, Burbank, California President: R. W. Prescott Vice President (Ops.): F. Lynott	4 Douglas DC-6A 8 Douglas DC-4 17 Curtiss C-46 *On order:* 10 Lockheed L-1049H Super Constellation	4,853	14,393,140	—	—	49,648,556 ton-miles	—
Frontier Airlines, Inc.	Stapleton Airfield, Denver 7, Colorado President: C. A. Myhre	15 Douglas DC-3 *On order:* 6 Fairchild F-27	3,617	5,354,359 *66,808*	190,719 *7,183*	1,414,680	4,445,728	—
Illini Airlines, Inc.	Greater Rockford Airport, Rockford, Illinois President: Douglas G. Harvey	3 D.H. Dove 1 Piper Apache 6 single-engined aircraft *On order:* 1 D.H. Heron	—	approx. 510,000	approx. 8,180	—	approx. 260,000	Apache and single-engine aircraft used in Flying School.
Lake Central Airlines, Inc.	Weir Cook Airport Indianapolis, Indiana President: G. Hicks Vice President (Ops.): R. W. Clifford	10 Douglas DC-3	1,745	2,354,067 *37,009*	135,720 *1,236*	406,220	2,262,400	—
Los Angeles Airways, Inc.	5901 West Imperial Highway, Los Angeles 45, California President: C. M. Belinn	5 Sikorsky S-55 2 Sikorsky S-51	Approx. 330	556,073 *3,181*	20,586 *1,007*	5,761,367	1,820,698	Operates scheduled passenger, mail and express helicopter services in Los Angeles area.
Mackey Airlines, Inc.	Broward International Airport, Fort Lauderdale, Florida President: J. C. Mackey Vice-President: L. J. Povey	4 Douglas DC-3 3 Douglas DC-4 1 Grumman Goose *On order:* 2 Fairchild F-27	1,920	712,022 *30,221*	48,031 *1,401*	—	28,000	—
Massachusetts Air Industries	Municipal Airport, New Bedford, Massachusetts Office Manager: Mario DiGiacomo	2 Riley Twin Navion 1 Beechcraft D-185 1 Cessna T-50 2 Cessna 140 2 Cessna 170	—	—	—	—	—	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
U.S.A.—*cont.*								
Mohawk Airlines, Inc.	Tompkins County Airport, Ithaca, New York Chairman: E. V. Underwood President: R. E. Peach	11 Douglas DC-3 8 Convair 240 *On order:* 3 Convair 240	1,530	4,042,000 *136,500*	353,494 *6,875*	810,000	3,040,000	—
National Airlines Inc.	3240, N.W. 27th Avenue, Miami 42, Florida President and Chairman: G. T. Baker Vice President (Ops.) L. W. Dymond	10 Lockheed Lodestar 12 Convair 340 6 Convair 440 4 Douglas DC-6 8 Douglas DC-6B 4 Douglas DC-7 *On order:* 4 Douglas DC-7B 4 Lockheed L-1049H Constellation 23 Lockheed Electra 6 Douglas DC-8	3,404	24,357,450 *618,882*	1,451,724 *5,725*	9,488,497	19,516,673	—
New York Airways, Inc.	P.O. Box 426, La Guardia Airport Station, Flushing 71, New York President: R. L. Cummings, Jr. Vice-President: H. Brock	2 Sikorsky S-58 5 Sikorsky S-55 1 Bell 47H *On order:* 1 Sikorsky S-58	257	429,224 *11,998*	42,972 *234*	1,159,704	2,513,297	Operates scheduled helicopter services in New York area.
North Central Airlines, Inc.	6201, 34th Avenue South, Minneapolis 50, Minn. President: H. N. Carr Chairman: A. E. A. Mueller Vice President (Ops.): A. D. Niemeyer	23 Douglas DC-3	3,240	7,754,836	549,654	2,174,801	4,959,925	—
Northeast Airlines, Inc.	Logan International Airport, Boston, Chairman: Paul F. Collins President: George E. Gardner Vice President (Ops.): A. A. Lane	12 Douglas DC-3 6 Convair 240 1 Curtiss CW-20-T *On order:* 10 Douglas DC-6B 5 Bristol Britannia	6,984 (Duplicated)	6,626,106 *215,518*	592,967	127,530 ton-miles	496,516 ton-miles	
Northwest Airlines, Inc.	1885, University Avenue, St. Paul 1, Minnesota President: D. W. Nyrop Exec. Vice-Pres.: M. S. Mackay Vice President (Ops.): F. C. Judd	4 Lockheed L-1049G Super Constellation 9 Boeing Stratocruiser 10 Douglas DC-6B 19 Douglas DC-4 (2 leased) 6 Douglas DC-3 *On order:* 14 Douglas DC-7C 10 Douglas DC-6B	17,445	31,421,118 *1,040,203*	1,427,063 *8,810*	16,869,700	35,833,947 *2,502,015*	Operates under popular name of Northwest Orient Airlines.
Ozark Air Lines, Inc.	P.O. Box 6007, Lambert Field, St. Louis 21, Missouri President: L. Hamilton Ops. Manager: F. E. Myers	20 Douglas DC-3 (3 leased)	3,266	5,190,785 *35,201*	317,197 *1,797*	1,431,351	3,978,289	—
Pacific Northern Airlines, Inc.	1626 Exchange Building, Seattle 4, Washington President: A. G. Woodley Vice President (Ops.): J. A. Cunningham	4 Douglas DC-3 2 Douglas DC-4 3 Lockheed Constellation	4,646	3,859,368 *70,851*	115,824 *1,407*	3,222,552	8,238,000 *524,000*	—
Pacific Southwest Airlines (P.S.A.)	3100 Goddard Way, San Diego, California President: K. G. Friedkin Chief of Ops: J. F. Andrews	3 Douglas DC-4	451	1,355,255	over 200,000	—	—	—
Pan American-Grace Airways, Inc. (Panagra)	135 East 42nd Street, New York 17, N.Y. President: A. B. Shea Vice President (Ops.): T. J. Kirkland	5 Douglas DC-7B 5 Douglas DC-6B 2 Douglas DC-4 4 Douglas DC-3 *On order:* 1 Douglas DC-7B 4 Douglas DC-8	5,458	5,646,333 *104,609*	141,200 *2,022*	1,106,263 ton-miles *206* ton-miles	3,966,891 ton-miles *62,270* ton-miles	—

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
U.S.A.—*cont.*								
Pan American World Airways, Inc. (P.A.A.)	135 East 42nd Street, New York 17, N.Y. President: Juan T. Trippe Vice-President-Admin: John C. Leslie	25 Boeing Stratocruiser 5 Convair 240 5 Douglas DC-3 26 Douglas DC-4 3 Douglas DC-6A 45 Douglas DC-6B (inc. 1 leased to Panagra) 4 Douglas DC-6 (leased from Panagra) 7 Douglas DC-7B 16 Douglas DC-7C 2 Lockheed 049 Constellation *On order:* 9 Douglas DC-7C 21 Douglas DC-8 6 Boeing 707-121 17 Boeing 707-321	64,085	94,829,756 *4,451,455*	2,504,098 *87,752*	35,785,333 ton-miles *156* ton-miles	80,922,984 ton-miles *2,605,046* ton-miles	—
Piedmont Aviation, Inc.	Smith Reynolds Airport, Winston-Salem, N.C. President and Treasurer: T. H. Davis Vice-President (Ops.): H. K. Saunders	21 Douglas DC-3 *On order:* 12 Fairchild F-27	3,173	6,907,402 *44,876*	403,784 *1,369*	1,483,436	2,910,622	—
Provincetown-Boston Airline Inc.	Municipal Airport, Provincetown, Massachusetts President: J. C. Van Arsdale	1 Lockheed Electra 10A 1 Lockheed Electra 10E 2 Cessna T-50	45	117,000 *58,000*	7,569 *3,386*	3,403	28,000 *3,000*	Operates year-round scheduled service between Boston and Cape Cod, plus considerable contract carrier activity.
Resort Airlines, Inc.	1346 Connecticut Avenue, N.W., Washington 6, D.C. Chairman: Clinton Davidson President: H. L. Graham Vice-President (Ops.): D. P. Larsen	8 Douglas DC-4 *On order:* 2 Lockheed L-1049H Super Constellation	40,738	— *5,465,158*	— *2,464*	—	— *96,770,000*	Operates scheduled cargo route for United States Air Force.
Riddle Airlines, Inc.	International Airport P.O. Box 535, Miami 48, Florida President: J. P. Riddle Exec. Vice-President: R. W. King	32 Curtiss C-46 4 Douglas DC-4 1 Douglas DC-6A *On order:* 4 Douglas DC-6A	7,738	23,231,484 *24,400,609*	—	319,795 *702,012*	42,168,676 *63,247,901*	Operates extensive scheduled all-cargo services, including a large number for the U.S. Armed Services.
Seaboard & Western Airlines, Inc.	80 Broad Street, New York 4, N.Y. President: R. A. Norden Exec. Vice-President: A. V. Norden	4 Lockheed L-1049D Super Constellation 1 Lockheed L-1049E Super Constellation 1 Lockheed L-1049H Super Constellation 4 Douglas C-54 2 Curtiss C-46 *On order:* 4 Lockheed L-1049H Super Constellation	6,202	2,101,028 *4,928,067*	—	—	5,148,000 *5,174,000*	All-freight operator. Began scheduled transatlantic services in April 1956.
Slick Airways, Inc.	3415 Cedar Springs Road, Dallas 19, Texas President: Robert J. Smith Chairman: D. W. Rentzel	6 Douglas DC-6A 8 Douglas DC-4 13 Curtiss C-46 *On order:* 7 Douglas DC-6A	19,000	7,999,046 *4,199,007*	— *41,564*	787,754 ton-miles	64,116,915 ton-miles *15,850,262* ton-miles	Scheduled air freight, mail and express carrier. In addition, flies cargo and passengers on charter basis.
Southern Airways, Inc.	1140 Brown-Marx Building, Birmingham, Alabama President: F. W. Hulse Vice-President (Ops.): W. S. Magill	13 Douglas DC-3	2,073	3,513,500 *102,854*	188,873 *882*	1,170,932	1,606,902	—
Southwest Airways Company	San Francisco International Airport, California President: J. H. Connelly Exec. Vice-President: T. R. Mitchell	10 Douglas DC-3 7 Martin 202	1,549	3,782,769 *266,028*	259,522 *29,718*	95,993	158,492	—
TAG Airlines, Inc.	Toledo, Ohio Gen. Manager: E. F. Knight Vice-President (Ops.): E. A. Eklund	2 D.H. Otter 1 D.H. Beaver	—	—	3,100	—	3,300	Formerly known as Taxi Air Group.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
U.S.A.—*cont.*								
Trans-Caribbean Airways, Inc.	New York City, N.Y. President: O. Roy Chalk Ops. Director: D. J. McFarland	Douglas DC-6 Douglas DC-4 Curtiss C-46	—	—	—	—	—	Operates low-fare week-end services between New York and San Juan, Puerto Rico.
Trans-Eastern Airways, Inc.	St. Petersburg, Florida President: J. R. Topping	Beechcraft 18 Grumman Widgeon Cessna 120 Cessna 195	—	—	—	—	—	Operates scheduled services from St. Petersburg to surrounding towns.
Transocean Air Lines	Metropolitan Oakland International Air Port, Oakland 4 California President: Orvis M. Nelson Senior Vice President: S. L. Wilson	2 Convair 9 Douglas DC-4 2 Grumman SA-16 Albatross	—	279,593 *3,151,240*	3,739 *22,896*	43,087 *108,642*	240,294 *3,032,031*	—
Trans-Texas Airways Inc.	International Airport, Houston 17, Texas President: R. E. McKaughan Vice-President (Ops.): H. E. Erdmann	18 Douglas DC-3	4,183	6,040,618 *16,378*	219,500 *1,113*	1,369,170	3,071,448	—
Trans World Airlines, Inc. (T.W.A.)	10, Richards Road, Kansas City 5, Missouri Chairman: W. L. Pierson President: C. L. Burgess	5 Douglas DC-3 10 Douglas DC-4 27 Lockheed L-049 Constellation 39 Lockheed L-749 Constellation 9 Lockheed L-1049 Super Constellation 28 Lockheed L-1049G Super Constellation 11 Martin 202A 37 Martin 404 *On order:* 8 Boeing 707 30 Convair 880 25 Lockheed L-1649A Starliner	35,000	106,617,195 *863,293*	4,406,751 *21,379*	33,268,940 *8,230*	76,325,416 *64,130*	—
United Air Lines, Inc. (U.A.L.)	5959, South Cicero Avenue, Chicago 38, Illinois President: W. A. Patterson Vice-President: R. E. Johnson	27 Douglas DC-7 5 Douglas DC-6A 30 Douglas DC-6B 42 Douglas DC-6 10 Douglas DC-4 3 Douglas DC-3 55 Convair 340 *On order:* 30 Douglas DC-8	14,000	121,692,000	6,266,000	28,184,000 ton-miles	63,608,000 ton-miles	—
West Coast Airlines, Inc.	Boeing Field, Seattle 8, Washington President: Nick Bez Vice-President (Ops.): E. B. Code	14 Douglas DC-3 *On order:* 4 Fairchild F-27	2,394	3,601,717 *23,746*	210,729 *4,145*	47,240 ton-miles	90,779 ton-miles	—
Western Air Lines Inc.	6060 Avion Drive, Los Angeles 45, California President: T. C. Drinkwater Vice-President (Ops.): S. R. Shatto	14 Douglas DC-6B 2 Douglas DC-4 5 Douglas DC-3 9 Convair 240 *On order:* 11 Douglas DC-6B 9 Lockheed Electra	6,350	14,851,000	928,746	8,068,000	8,332,000	—
VENEZUELA								
Aerovias Venezolanas, S.A. (AVENSA)	Apartado 943, Caracas President: H. L. Boulton Gen. Manager: Andres Boulton	5 Convair 340 15 Douglas DC-3 3 Douglas C-47 (Freighter) 3 Curtiss C-46 (Freighter)	5,600	5,548,597 (inc. non-scheduled)	299,590 (inc. non-scheduled)	77,162 (inc. non-scheduled)	24,809,392	Pan American World Airways holds a 30% interest.
Linea Aérea Taca de Venezuela, C.A.	—	—	—	—	—	—	—	Now merged with Linea Aeropostal Venezolana.
Linea Aeropostal Venezolana (L.A.V.)	Bloque 1, El Silencio Caracas President: Col. L. Calderon	3 Vickers Viscount 749 1 Lockheed L1049G Super Constellation 1 Lockheed L-1049C Super Constellation 3 Lockheed Constellation 18 Douglas DC-3 2 Martin 202 4 Curtiss C-46	20,977	7,578,000 *705,000*	244,461	509,848 ton-miles	4,560,287 ton-miles	—
Rutas Aereas Nacionales S.A. (Ransa)	Edificio America, Caracas President: Carlos Chavez Ops. Manager: R. D. Borges	13 Curtiss C-46 3 Douglas DC-3 5 Cessna 180 1 Cessna 170 2 D.H. Beaver	14,510	—	—	—	—	Operating only freight services at present.

Non-scheduled traffic figures in italic type.

Airline	Head Office and Management	Fleet	Route Mileage	Miles Flown 1956	Passengers 1956	Mail (lb.) 1956	Freight (lb.) 1956	Remarks
VIETNAM								
Aigle Azur Extreme Orient	Saigon	6 Boeing 307 Stratoliner 6 Douglas DC-3 1 Bristol Freighter 1 Curtiss C-46 2 D.H. Otter 2 D.H. Beaver	—	2,832,831	76,800	—	21,384,800	Formed in Nov. 1955 by merger of Air Azur Indochine and Aero Cargo.
Air Vietnam	116, Boulevard Nguyen-Hue, Saigon President: Nguyen Van Khai Manager: Nguyen Tan Trung	7 Douglas DC-3 4 Bristol Freighter	11,930	1,414,752 *206,526*	101,757 *4,950*	593,206 *6,047*	5,364,840 *926,389*	Vietnam Government has 50% interest. Other 50% held by Air France and local companies.
YUGOSLAVIA								
Jugoslovenski Aerotransport (J.A.T.)	P.O. Box 749, Bircaninova 1/III, Belgrade Gen. Manager: Milan Simovic Traffic Manager: Milan Rakic	13 Douglas DC-3 1 Convair 340 1 Convair 440 *On order:* 1 Convair 440 6 Ilyushin Il-14	7,801	1,843,046 *83,556*	91,396 *2,518*	957,458 *1,263*	1,173,306 *32,461*	State-owned.

Non-scheduled traffic figures in italic type.

ALL THE WORLD'S AEROPLANES

(CORRECTED TO SEPTEMBER 30, 1957).

SOME FIRST FLIGHTS MADE DURING THE PERIOD JULY 30, 1956 — AUGUST 9, 1957

1956

July

30 Pasotti Sparviero (Italy)

August

2 Wassmer Javelot (France)
6 Beechcraft Travel Air (U.S.A.)
9 Nord 2500E (France)
11 Cessna Model 620 (U.S.A.)
13 North American F-100F (U.S.A.)
20 Gloster Javelin T. Mk. 3 (G.B.)
24 Gloster Javelin F. (A.W.) Mk. 5 (1st production) (G.B.)

September

20 Kingsford Smith PL-7 (Australia)
27 Kaman HOK-1 (XT-53 engine) (U.S.A.)

October

6 Breguet 1050 Alizé (1st prototype) (France)
11 Lockheed L-1649A Starliner (U.S.A.)
11 Transland Ag-2 (U.S.A.)
14 Nardi FN-333 (pre-production) (Italy)
17 Dornier Do 27 (1st production) (Germany)
22 Bell XH-40 (U.S.A.)

November

5 Fouga CM.171 Makalu (France)
9 Bristol 173 (Leonides Major engines) (G.B.)
9 Gloster Javelin F. (A.W.) Mk. 7 (1st production) (G.B.)
10 Sud-Aviation S.O.4050 Voutour IIN (1st production) (France)
11 Convair B-58 Hustler (U.S.A.)
12 Rolls-Royce "Flying Bedstead" (2nd prototype) (G.B.)
17 Dassault Mirage III (France)

December

4 North American FJ-4B Fury (U.S.A.)
14 Gloster Javelin F. (A.W.) Mk. 6 (G.B.)
17 Dassault Mirage I (with SEPR rocket) (France)
18 Aero Commander 560E (U.S.A.)
19 Stroukoff YC-134 (U.S.A.)
21 Breguet 1050 Alizé (2nd prototype) (France)
26 Convair F-106A (U.S.A.)
26 Leduc O.22 (France)
26 Omega BS-12 Twin (U.S.A.)
31 Bristol Britannia 312 (G.B.)

1957

January

7 Saab J-32B Lansen (Sweden)
11 Hispano H.A. 200 Saeta (2nd prototype) (Spain)
15 Gloster Javelin F. (A.W.) Mk. 6 (1st production) (G.B.)

1957

January

29 Fokker Friendship (2nd prototype) (Netherlands)
30 Sikorsky HSS-2 (General Electric T58 engines) (U.S.A.)

February

7 Lockheed F-104B (U.S.A.)
26 Dassault Super-Mystère B-2 (1st production) (France)
26 Hurel-Dubois H.D. 34 (France)
? Champion Model 7FC (U.S.A.)

March

1 Grumman WF-2 Tracer (U.S.A.)
2 Thruxton Jackaroo (G.B.)
8 North American F-100F (1st production) (U.S.A.)
14 Blume B1 500 (Germany)
15 Dassault Etendard VI (France)
20 de Havilland Sea Vixen (production form) (G.B.)
26 Saab S-32C Lansen (Sweden)
27 McDonnell F-101B Voodoo (U.S.A.)
28 Canadair CL-28 Argus (Canada)
28 Morane-Saulnier M.S. 760 Paris (2nd prototype) (France)
31 Breguet 1100 (France)
31 Miles HDM-105 (G.B.)

April

2 Short S.C.1 (G.B.)
4 English Electric P.1B (G.B.)
11 Ryan X-13 Vertijet (1st translational flight) (U.S.A.)
17 Nord 3202 (France)
26 Nord 1500-02 Griffon II (with ramjet) (France)

May

3 Sud-Aviation S.O. 9050 Trident II (1st pre-production) (France)
10 Sud-Aviation Gouverneur (France)
14 Breguet 902 (France)
14 Miles M.100 Student (G.B.)
14 SNECMA Atar Volant P.2 (France)
16 Saunders-Roe S-R.53 (G.B.)
16 Sud-Aviation S.E. 3140 (France)
17 Westland Wessex (G.B.)

June

1 First Short-built Britannia 305 (G.B.)

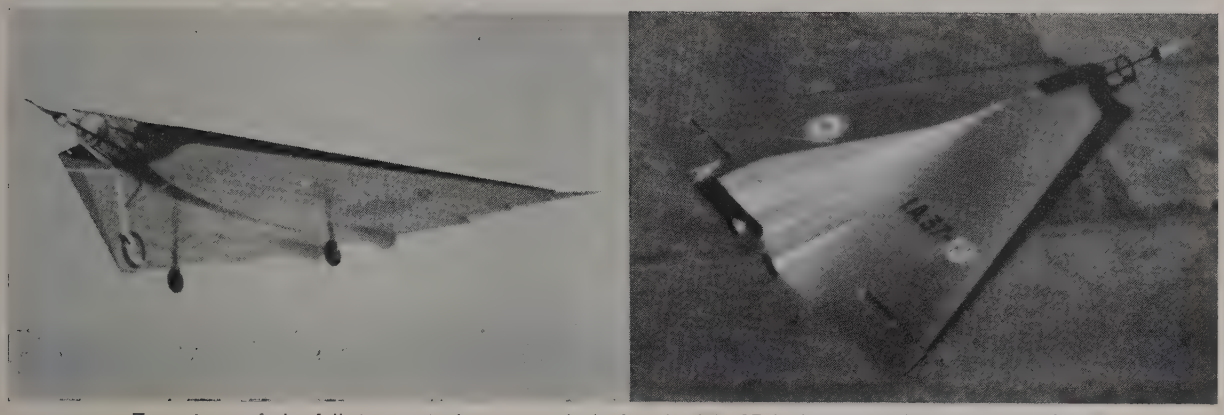
July

9 Aviation Traders Accountant (G.B.)
? Hollandair HA-001 (Netherlands)
26 Breguet 1001 Taon (France)

August

9 Vickers Viscount 806/810 (G.B.)

THE ARGENTINE REPUBLIC



Two views of the full-size engineless test vehicle for the I.A. 37 high-speed delta-wing monoplane.

FABRICA MILITAR DE AVIONES (INSTITUTO AEROTECNICO).

CORDOBA.

The Fabrica Militar de Aviones was established at Cordoba in 1927 and at the outset built aircraft and aero-engines of various foreign designs under licence. It began the design and manufacture of aircraft of its own design in 1932.

In 1946 the name of the establishment was changed to Instituto Aerotecnico when its control was transferred from the Ministry of War to the then newly-formed Secretariat of Aeronautics. In 1952 it became part of the Industrias Aeronaúticas y Mecánicas del Estado (I.A.M.E.) which was formed to take over and control all State activities concerned with the design and construction of aircraft, engines, accessories, equipment and materials, both military and civil, used in the Republic.

On July 1, 1956, the establishment resumed its original name of Fabrica Militar de Aviones.

Important products of this factory have included the Pulqúi I, the first jet-propelled aircraft to be designed, built and flown in Latin America; and the Pulqúi II, the first Latin American swept-wing jet fighter. The former flew for the first time on August 9, 1947, and the latter on June 27, 1950. Both have been described fully in earlier editions of "All the World's Aircraft."

Other interesting products of the Cordoba factory have included two tailless gliders designed by the German Dr. Reimar Horten, who is technical adviser to the organisation.

Under Dr. Horten's guidance, a new programme is under way to develop a nigh-speed delta-wing aircraft in three stages, beginning with a glider and progressing through an intermediate medium-speed powered aircraft stage to the final version. All three types are covered by the designation I.A.37. The glider has completed its initial test flights.

In addition, the factory is working on the design and construction of a twin-engined civil executive transport known as the I.A.45 and an agricultural aircraft designated the I.A.46. Brief details of these new types are given below.

Current production is centered on the I.A.35 twin-engined general-purpose monoplane and the Beechcraft T-34 Mentor, of which 75 are being assembled under licence from Beech Aircraft Corporation of Wichita, Kansas. Assembly, also under licence, of 48 Morane-Saulnier M.S. 760 Paris twin-jet liaison aircraft is scheduled to start in March, 1958.

A total of 8,500 persons is employed at the Fabrica Militar de Aviones.

THE I.A. 46.

Now under design and construction, the I.A.46 will be a single-engined high-wing monoplane for agricultural duties. It will be of welded steel-tube construction, fabric-covered, with a non-retractable landing gear.

THE I.A. 45.

The I.A.45 is a twin-engined executive transport, of which a prototype is being built at Cordoba. Designed to carry a crew of two and three passengers, it is of all-metal construction, with a retractable tricycle landing gear. Its airscrews are arranged as "pushers."

THE I.A. 37.

Most important current project of the Fabrica Militar de Aviones is the development of a high-speed delta-wing aircraft known as the I.A.37. As the first stage, a glider of the same form and dimensions as the powered aircraft has been built and flight-tested. Next will come an all-metal powered version for tests at medium speeds, after which the fully developed high-speed version will be built.

The following details apply to the medium-speed version.

TYPE.—Single-seat Research and Training monoplane.

WINGS.—Cantilever mid-wing delta monoplane. Leading edge sweepback 63° 5′. No dihedral or incidence. All-metal structure with cambered leading-edge. Wing area 48 m.² (516 sq. ft.).

FUSELAGE.—All-metal semi-monocoque cockpit nacelle only.

TAIL UNIT.—Cantilever monoplane fin and rudder only. Fin sweepback 72°.

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Oleo-pneumatic shock-absorbers.

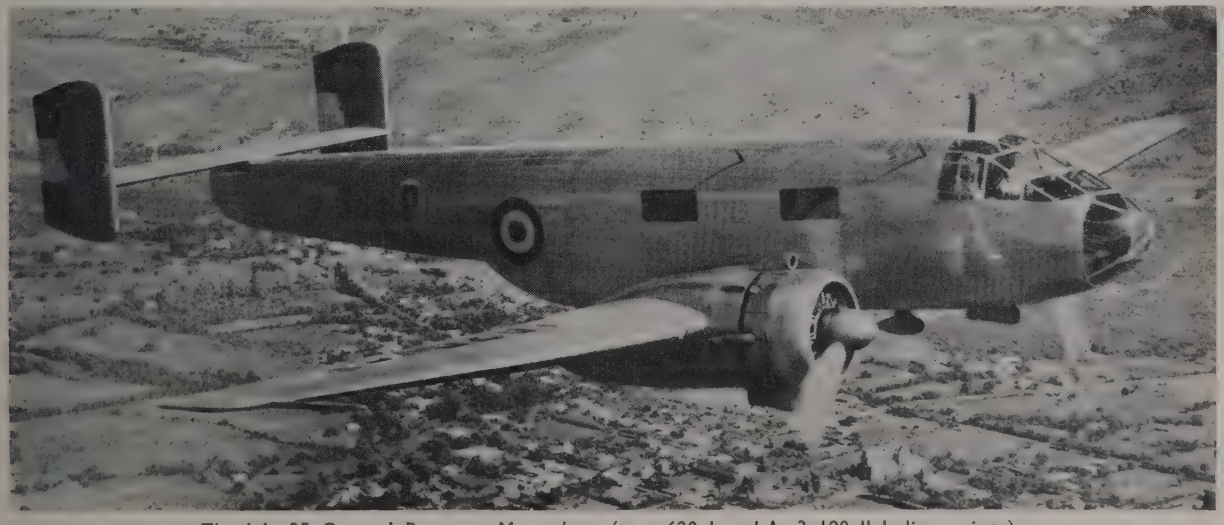
POWER PLANT.—One Rolls-Royce Derwent 5 turbojet engine (1,633 kg. = 3,600 lb. s.t.).

ACCOMMODATION.—Cockpit nacelle for pilot, equipped with ejector seat.

ARMAMENT.—Two 20 mm. cannon.

DIMENSIONS AND WEIGHTS.—
Not available.

PERFORMANCE (estimated).—
Max. speed at 8,000 m. (26,250 ft.) 800 km.h. (500 m.p.h.).
Landing speed 110 km.h. (68 m.p.h.).



The I.A. 35 General Purposes Monoplane (two 620 h.p. I.A. 3 190 II Indio engines).



The I.A. 35 General Purposes Monoplane (two 620 h.p. I.A. 3 190 II Indio engines).

Rate of climb at S/L. 1,020 m./min. (3,345 ft./min.).
Service ceiling 11,600 m. (38,050 ft.).

THE I.A. 35.

The I.A.35, which is in production, is a twin-engined aircraft designed to fulfil a multiplicity of duties. It may be adapted as (*a*) a light transport carrying a crew of three and eight passengers ; (*b*) an ambulance with accommodation for a crew of three, four stretcher cases and two medical attendants ; (*c*) an advanced pilot or crew trainer for a crew of three, one instructor and four pupils ; (*d*) a light reconnaissance or photographic aircraft with a crew of four and special equipment; and (*e*) a light bomber with a crew of five, machine-gun armament and stowage for medium-calibre bombs.

TYPE.—Twin-engined General Purposes monoplane.

WINGS.—Low-wing cantilever monoplane. Wing in three sections of all-metal construction. Flaps inboard of ailerons. Thermal de-icing.

FUSELAGE.—All-metal structure in four sections.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. All-metal construction.

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction.

POWER PLANT.—Two 620 h.p. I.A. 3 190 I1 Indio nine-cylinder radial air-cooled supercharged engines. Rotol three-blade controllable-pitch airscrews. Fuel tanks in wings.

ACCOMMODATION.—Crew in forward section of fuselage, cabin in centre section. Accommodation varies according to function of aircraft. See introduction.

DIMENSIONS.—
Span 19.6 m. (64 ft. 3 in.).
Length 13.98 m. (45 ft. 10 in.).

WEIGHTS.—
Weight empty 3,500 kg. (7,700 lb.).
Normal loaded weight 5,700 kg. (12,540 lb.).

PERFORMANCE.—
Max. speed 363 km.h. (225 m.p.h.).
Max. cruising speed 353 km.h. (219 m.p.h.).
Most economic cruising speed 346 km.h. (214.8 m.p.h.).
Landing speed 114 km.h. (70.8 m.p.h.).
Ceiling 6,500 m. (21,320 ft.).
Range 1,500 km. (930 miles).

AUSTRIA

OFW

ÖSTERREICHISCHES FLUGZEUGWERK G.m.b.H.

HEAD OFFICE : SALESIANERGASSE 1, VIENNA.

AERODROMES : ASPERN AND WIENER-NEUSTADT.

This new company has built the prototype of a side-by-side two-seat light aeroplane, known as the OK-15, which was the first powered aircraft produced in Austria since the war.

Built entirely of commercially-available Austrian materials, except for its engine and tyres, the standard OK-15 is fully aerobatic and is suitable for *ab initio* and aerobatic training, touring, glider and banner towing and other duties. A de luxe version with dynamo, starter, starter battery and lighting for night flying is also available ; but this version is not aerobatic.

THE OFW OK-15.

TYPE.—Two-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Aspect ratio 5.25. Composite construction. with single steel box-spar and wooden ribs. Plywood covering, except for under-surface which is fabric-covered aft of spar. All-wood ailerons with controllable trim tabs. Metal flaps with fabric covering. Wing area 11 m.^{2} (118 sq. ft.).

FUSELAGE.—Tubular-steel structure, with metal covering from fireproof bulkhead to trailing edge of wing and plywood covering aft of wing.

TAIL UNIT.—Cantilever monoplane type. Metal structure with fabric-covering.



The OFW OK-15 Light Monoplane (105 h.p. Walter Minor 4-III engine).

LANDING GEAR.—Non-retractable tail-wheel type. Cantilever main wheel units. Hydraulic brakes. Main wheel tyres 380 × 150 mm. (15.00 × 6 in.). Steerable tail-wheel swivels through 360°.

POWER PLANT.—One Walter Minor 4-III four-cylinder inverted in-line air-cooled engine giving 105 h.p. for take-off and a continuous output of 80 h.p. at 2,300 r.p.m. Two-blade fixed-pitch wooden airscrew. 90 litre (19.8 Imp. gallon) fuel tank in fuselage aft of firewall.

ACCOMMODATION.—Two seats side-by-side, with dual controls, under jettisonable transparent canopy. Luggage space aft of seats.

DIMENSIONS.—
Span 7.60 m. (24 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
Height 1.73 m. (5 ft. 8 in.).

WEIGHTS AND LOADINGS.—
Weight empty 504 kg. (1,111 lb.).
Max. loaded weight 788 kg. (1,737 lb.).
Wing loading 71.63 kg./m.^{2} (14.67 lb./sq. ft.).
Power loading 7.5 kg./h.p. (16.5 lb./h.p.).

PERFORMANCE (at max. A.U.W.).—
Max. speed at 300 m. (985 ft.) 202 km.h. (125 m.p.h.).
Cruising speed at 300 m. (985 ft.) 175 km.h. (109 m.p.h.).
Landing speed 75 km.h. (46.5 m.p.h.).
Rate of climb at S/L. 200 m./min. (655 ft./min.).
Time to 1,000 m. (3,280 ft.) 6 min. 45 sec.
Service ceiling 3,500 m. (11,500 ft.).
Take-off run on grass 200 m. (655 ft.).
Landing run on grass 110 m. (360 ft.).
Range 630 km. (390 miles).
Endurance with reserve 3½ hours.

BELGIUM

AVIONS FAIREY

AVIONS FAIREY S.A.

HEAD OFFICE, WORKS AND AERODROME: GOSSELIES, NEAR CHARLEROI.

Managing Director: Mr. E. O. Tips, A.F.R.Ae.S., C.O.C.

This Belgian company was formed in 1931 as a subsidiary of the English Fairey Aviation Co., Ltd. Its factory suffered considerable damage from bombing on May 10, 1940, but was rebuilt after the liberation, and Avions Fairey is now engaged on the design, construction, repair and overhaul of military and civil aircraft.

Since 1935, Mr. E. O. Tips has designed and built a succession of light aircraft, many of which are still flying in various parts of the world.

Production of these light planes has had to be discontinued temporarily owing to heavy commitments on other work. However, a specially cleaned-up and modified version of the standard two-seat Belfair, with larger fuel and oil capacity, holds the international distance record (F.A.I. Class C.1a) for aircraft under 500 kg. loaded weight, with a flight of 2,632.5 km. (1,636 miles) on August 4, 1955.

Since completing large production and modification contracts for Gloster Meteor aircraft for the Belgian Government, Avions Fairey has expanded its facilities very considerably in order to cope with the construction of a substantial number of Hawker Hunter Mk. 4 and Mk. 6 fighters for N.A.T.O. and the Belgian Air Force.

The company also has a contract for the IRAN (Inspection and Repair As Necessary) of a large number of F-84F Thunderstreak aircraft for the Belgian Air Force.

SABCA

SOCIÉTÉ ANONYME BELGE DE CONSTRUCTIONS AÉRONAUTIQUES.

HEAD OFFICE: 1,470 CHAUSÉE DE HAECHT, HAREN-BRUSSELS.

WORKS: HAREN-BRUSSELS AND GOSSELIES.

The Société Anonyme Belge de Constructions Aéronautiques was, before the late war, the largest aircraft works in Belgium. In addition to building aircraft and aero-engines under licence for the Belgian Government and the S.A.B. E.N.A.company, it also designed and built aircraft of original design.

To-day, apart from undertaking the study of certain aircraft design projects, the company is engaged in the assembly, maintenance and repair of Republic F-84 fighter aircraft, and is collaborating with Avions Fairey in the production of a series of Hawker Hunter single-seat fighters for the Belgian Government.

Under an agreement announced in August 1956, SABCA is also producing components for the S.O.4050 Vautour aircraft under sub-contract to the French Sud-Aviation company.

SABCA now has special facilities for the manufacture of landing-gears, hydraulic systems and fuel systems.

STAMPE ET RENARD

CONSTRUCTIONS AÉRONAUTIQUES STAMPE ET RENARD S.A.

HEAD OFFICE AND WORKS: 34-36, AVENUE J. BORDET, EVERE-BRUXELLES.

This company has been formed since the war by the merger of the former pre-war companies Constructions Aéronautiques, G. Renard and J. Stampe et M. Vertongen. It is engaged in extensive overhaul and modification of the S.V.4 biplane, designed pre-war by Stampe et Vertongen, which is used in large numbers by the air forces of Belgium and France.

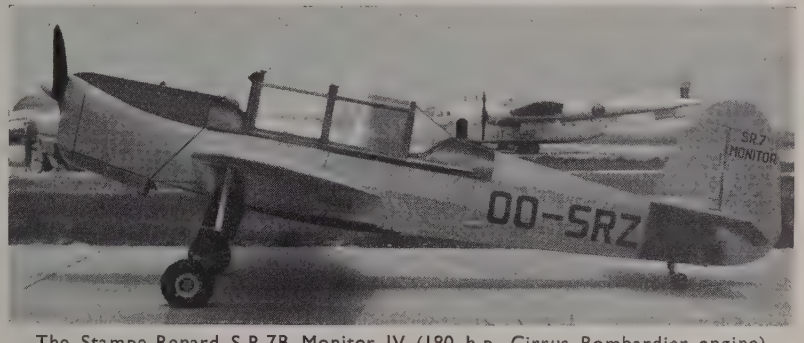
In addition, Stampe et Renard is continuing development of the Monitor training monoplane, which was built originally by the French Farman company in collaboration with M. Stampe. This aircraft, which uses fuselage components of the S.V.4, is described hereafter.

THE STAMPE-RENARD S.R.7B MONITOR IV.

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. Dihedral 5°. Incidence 4° at root, 0° at tip. Chord 1.80 m. (5 ft. 10 in.) at root, 1.20 m. (3 ft. 11 in.) at tip. Centre-section, integral with fuselage, is a steel-tube structure. Outer wings have two spruce and plywood spars with plywood covering in between, and a plywood D leading-edge. Fabric covering aft of rear spar. Differential ailerons are statically and dynamically balanced. Split flaps between ailerons and fuselage. Total area of ailerons 1.46 m.² (15.72 sq. ft.). Total area of flaps 1.56 m.² (16.79 sq. ft.). Gross wing area 14 m.² (150.6 sq. ft.).

FUSELAGE.—Steel and light alloy tubular structure, with both welded and bolted joints. Fabric-covered.



The Stampe-Renard S.R.7B Monitor IV (180 h.p. Cirrus Bombardier engine).

TAIL UNIT.—Wire-braced monoplane type. All surfaces have fabric-covered wooden structure. Areas: fin 0.37 m.² (3.98 sq. ft.), rudder 0.85 m.² (9.15 sq. ft.), tailplane 1.30 m.² (14.0 sq. ft.), elevators 1.10 m.² (11.84 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever main legs with rubber-in-compression springing. 6 in.×6½ in. or 420 mm.×165 mm. wheels. Hydraulic brakes. Solid tyre on tail-wheel. Track 2.78 m. (9 ft. 1½ in.).

POWER PLANT.—One 180 h.p. Blackburn Cirrus Bombardier 702 four-cylinder in-line inverted air-cooled engine, driving two-blade fixed-pitch airscrew. Engine installed as quickly removable power-unit. Two fuel tanks (58 litres=12.75 Imp. gallons each), one in each wing root. Two auxiliary tanks of 50 litres (11 Imp. gallons) each can also be installed if desired.

ACCOMMODATION.—Tandem cockpits beneath continuous canopy. Canopy can be jettisoned in an emergency. Dual controls and instrumentation. Amber screening available for simulated night or blind flying training. Seats take seat-type parachutes.

DIMENSIONS.—
Span 9.44 m. (30 ft. 11 in.).
Length 7.28 m. (23 ft. 10½ in.).
Height 2.20 m. (7 ft. 3 in.).

WEIGHT.—
Max. loaded weight 930 kg. (2,050 lb.).

PERFORMANCE.—
Economic cruising speed 200 km.h. (124 m.p.h.).
Rate of climb at S/L. (930 kg.=2,050 lb.) 280 m./min. (920 ft./min.).
Take-off distance to 15.25 m. (50 ft.) in zero wind 240 m. (785 ft.).
Landing run, with brakes, 140 m. (460 ft.).
Normal range more than 550 km. (342 miles).
Max. range (216 litres=47.5 Imp. gallons) 1,000 km. (620 miles).

BRAZIL

FOKKER

FOKKER INDÚSTRIA AERONÁUTICA S.A.

HEAD OFFICE: RUA DA ASSEMBLEIA 11 (SALA 503), RIO DE JANEIRO.

WORKS: GALEÃO AIRPORT, RIO DE JANEIRO.

This company was formed with the assistance of the Brazilian Government, and occupies the former Government factory on the Galeão Airport in return for a small annual payment. The Dutch Fokker company has a financial interest in the Brazilian company, which holds production licences for the S.11, S.12 and S.14 trainers. The parent company has provided jigs and tools for production.

The company has received initial orders from the Brazilian Government for 100 S.11 Instructors, 50 S.12's and 50 S.14 Mach-Trainer I's to be powered by Rolls-Royce Derwent engines.



The first Brazilian-built Fokker S.11 (190 h.p. Lycoming O-435 engine).

Of these aircraft, 20 S.11's had been delivered by February, 1957, when production of the S.14 had also started.

The possibility of producing the Fokker F-27 Friendship airliner in Brazil is under consideration.

I.P.T.

INSTITUTO DE PESQUISAS TECNOLOGICAS (Institute of Technical Research).

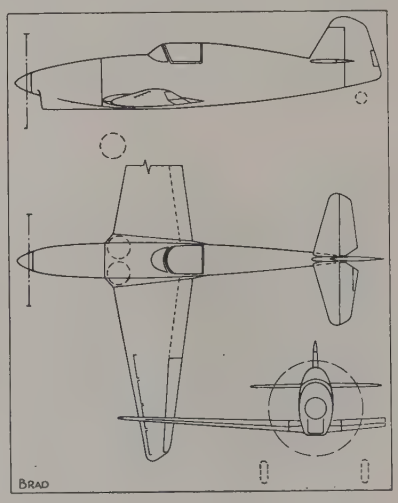
HEAD OFFICE: PRAÇA CEL. FERNANDO PRESTES, 110, CAIXA POSTAL 7141, SÃO PAULO.

Director of the Institute: Prof. F. J. H. Maffei.

Chief of the Aeronautical Section: Eng. Romeu Corsini.

This establishment, which is principally engaged in research, particularly with regard to the qualities of national materials suitable for use by the Brazilian Aircraft Industry, has designed and built a number of prototypes of light aircraft, sailplanes and gliders. These are mainly experimental prototypes and are not intended for commercial production. They employ materials and equipment of national origin, notably structural members, plywood and airscrews of indigenous timbers, the qualities of which are being investigated by the I.P.T.

The types I.P.T. 0 to I.P.T. 14 have been described in previous editions of "All the World's Aircraft." The latest designs are the I.P.T. 16 single-seat light cabin monoplane and the I.P.T. 17, a high-performance sailplane.



The I.P.T. 16.

THE I.P.T. 16.

TYPE.—Single-seat Light Cabin monoplane.

WINGS.—One-piece cantilever low-wing monoplane. Aspect ratio 7.4. Taper ratio 1 : 0.25. Two-spar wooden structure with plywood covering. Mechanically-operated split trailing-edge flaps between ailerons and fuselage. Letterbox fixed slots in wings ahead of ailerons. Wing area 86.4 sq. ft. (8.0 m.²).

FUSELAGE.—Wooden monocoque structure with stressed plywood skin.

TAIL UNIT.—Cantilever monoplane type. Wooden structure with plywood covering on rudder and elevators. Controllable trim-tab in starboard elevator.

LANDING GEAR.—Retractable tail-wheel type. Each main wheel is carried in half-fork on oleo-spring shock-absorber leg, is retracted inwards under wing and fuselage and is contained in well projecting ahead of leading-edge. Mechanical operation. Hydraulic brakes. Non-retractable tail-wheel.

POWER PLANT.—One 160 h.p. inverted four-cylinder air-cooled engine driving a two-blade wooden airscrew. Fuel capacity 120 litres (26.4 Imp. gallons).

DIMENSIONS.—
Span 7.7 m. (25 ft. 2 in.).
Length 7.0 m. (23 ft.).
Height 2.1 m. (6 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 440 kg. (970 lb.).
Disposable weight 200 kg. (440 lb.).
Weight loaded 640 kg. (1,410 lb.).
Wing loading 80.5 kg./m.² (16.5 lb./sq. ft.).
Power loading 4 kg./h.p. (8.8 lb./h.p.).

PERFORMANCE.—
Max. speed 340 km./h. (212 m.p.h.).
Cruising speed 300 km./h. (187 m.p.h.).
Stalling speed 90 km./h. (56 m.p.h.).
Endurance 3.5 hrs.
Range 1,050 km. (650 miles).

THE I.P.T. 17.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Cantilever monoplane. NACA 643-618 wing section. Aspect ratio 22. Chord 1.33 m. (4 ft. 4 in.) at root, 0.39 m. (1 ft. 4 in.) at tip. Dihedral 2° 30′. Incidence 4° 30′. All-wood monospar semi-monocoque structure with stressed plywood skin. All-wood Fowler type flaps. Differentially-controlled top-hinged all-wood ailerons. Area of flaps 2.0 m.² (21.5 sq. ft.). Area of ailerons 1.4 m.² (15 sq. ft.). Gross wing area 16.4 m.² (175 sq. ft.).

FUSELAGE.—All-wood monocoque structure with plywood skin. Width of fuselage 0.6 m. (2 ft.).

TAIL UNIT.—Cantilever monoplane type. Wood structure with plywood-covered fixed surfaces and fabric-covered elevators and rudder. Controllable trim-tab in starboard elevator. Areas: fin 0.186 m.² (2 sq. ft.), rudder 0.9 m.² (9.6 sq. ft.), tailplane 1.31 m.² (12.2 sq. ft.), elevators 0.79 m.² (8.5 sq. ft.). Tailplane span 3.2 m. (10 ft. 6 in.).

LANDING GEAR.—Permanent central skid. Auxiliary detachable gear for take-off.

ACCOMMODATION.—Enclosed cockpit for pilot with moulded Plexiglas canopy conforming to lines of fuselage.

DIMENSIONS.—
Span 19 m. (62 ft. 6 in.).
Length 7.70 m. (25 ft.).
Height overall 1.44 m. (4 ft. 8 in.).

WEIGHTS (Designed).—
Weight empty 270 kg. (600 lb.).
Useful load 90 kg. (200 lb.).
Weight loaded 360 kg. (800 lb.).

PERFORMANCE (Estimated).—
Best gliding ratio 1 : 38 at 76 km.h. (47 m.p.h.).
Min. sinking speed 0.53 m./sec. (1 ft. 9 in./sec.) at 61 km.h. (38 m.p.h.).

NEIVA

SOCIEDADE CONSTRUTORA AERONÁUTICA NEIVA, LTDA.

HEAD OFFICE AND WORKS: RUA N.S. DE FATIMA, 360, BOTUCATÚ, SÃO PAULO.

Technical Director: J. C. de Barros Neiva.

This concern is supplying Neiva BN-1 single-seat and B-2 Monitor two-seat sailplanes for use in the Brazilian Government's gliding clubs programme. The B-2 holds the South American duration record for two-seat sailplanes with a flight of 11 hours 37 minutes.

In the second Brazilian National Soaring Competition a BN-1 took first place and also put up three new Brazilian records, including a goal flight of 332 km. (206 miles).

In the third National Soaring Competition four BN-1's took first, second, third and fifth places, against competition from 12 sailplanes of European and North American design.

Under an expansion programme, Neiva has now moved from Rio de Janeiro to a new plant at Botucatú, in the State of São Paulo, where it is also building the Paulistinha-56 light cabin monoplane. A new version of this aircraft, known as the Super Paulistinha, and the BN-1 Especial high-performance sailplane are under development.

THE NEIVA PAULISTINHA-56.

Designed and built originally by the Companhia Aeronáutica Paulista of São Paulo, the Paulistinha has now been put back into production with a 90 h.p. Continental engine instead of the original 65 h.p. Franklin engine.

TYPE.—Two-seat Light Primary Training and Touring monoplane.

WINGS. — High-wing braced monoplane. Wings attached direct to built-in centre-section in top of fuselage and braced to lower longerons by streamline steel-tube Vee struts. Two-spar wooden wing structure with fabric covering. Slotted ailerons. Fixed slots in leading edge forward of ailerons. Wing area 17.00 m.² (183 sq. ft.).

FUSELAGE.—Rectangular welded steel-tube framework, fabric-covered over light wood fairing structure.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework, fabric-covered. Tie-rod bracing above and below tailplane. Horizontal tail area 2.43 m.² (26.16 sq. ft.). Vertical tail area 1.00 m.² (10.76 sq. ft.).

LANDING GEAR.—Divided type. Two side Vees and two inclined half-axles hinged at their inner ends to a Vee cabane below

fuselage. Oleo shock-absorbers. Medium-pressure wheels with brakes.

POWER PLANT.—One 90 h.p. Continental C90-8F four-cylinder horizontally-opposed air-cooled engine. Two-blade wooden airscrew.

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Door on starboard side. Space for baggage behind rear seat.

DIMENSIONS.—
Span 10.76 m. (35 ft. 3½ in.).
Length 6.76 m. (22 ft. 2 in.).

WEIGHTS AND LOADINGS.—
Weight empty 390 kg. (860 lb.).
Weight loaded 587 kg. (1,294 lb.).
Wing loading 34.0 kg./m.² (6.96 lb./sq. ft.).
Power loading 6.5 kg./h.p. (14.3 lb./h.p.).

PERFORMANCE (estimated).—
Max. cruising speed 160 km.h. (99 m.p.h.).
Normal cruising speed 145 km.h. (90 m.p.h.)
Landing speed 47 km.h. (29.2 m.p.h.).
Rate of climb at S/L 240 m./min. (785 ft./min.).
Ceiling 4,200 m. (13,780 ft.).
Range 700 km. (435 miles).

THE NEIVA BN-1.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Cantilever high-wing monoplane. Wing section NACA 4415 at root, NACA 4412 at mid-span and NACA 2R1 12 at tip. Aspect ratio 19. Chord at root 1.28 m. (4 ft. 2 in.), at tip 0.42 m. (1 ft. 4½ in.). Dihedral 2°. Incidence 4° at root. Single I-spar structure with plywood-covered torsion-resistant leading-edge and upper surface. Fabric covering on undersurface. Wood-framed fabric-covered ailerons with differential control. Wood spoiler flaps. Area of ailerons (2) 2.0 m.² (21.5 sq. ft.). Gross wing area 13.47 m.² (144.9 sq. ft.).

FUSELAGE.—All-wood semi-monocoque structure. Frontal area 0.42 m.² (4.52 sq. ft.).

TAIL UNIT.—Cantilever monoplane type. Wood frames with plywood and fabric covering. Areas: fin 0.35 m.² (3.7 sq. ft.), rudder 0.65 m.² (7.0 sq. ft.), tailplane and elevator 1.60 m.² (17.2 sq. ft.). Tailplane span 3 m. (9 ft. 11 in.).

LANDING GEAR.—Front skid and retractable single Goodyear wheel aft of C.G.

ACCOMMODATION. — Enclosed cockpit. Moulded Plexiglas canopy.

DIMENSIONS.—
Span 16.0 m. (52 ft. 6 in.).
Length 6.90 m. (22 ft. 7½ in.).
Height 1.02 m. (3 ft. 4 in.).



The Neiva Paulistinha-56 (90 h.p. Continental C90 engine).

WEIGHTS.—Weight empty 170 kg. (374 lb.).
Disposable load 80 kg. (176 lb.).
Weight loaded 250 kg. (550 lb.).
Wing loading 18.5 kg./m.² (3.79 lb./sq. ft.).

PERFORMANCE.—
Stalling speed 50 km.h. (31 m.p.h.).
Min. sinking speed 0.54 m./sec. (1.7 ft./sec.) at 60 km.h. (37.3 m.p.h.).
Best gliding ratio 1 : 31 at 76 km.h. (47 m.p.h.).
Sinking speed at 100 km.h. (62 m.p.h.) 1.3 m./sec. (4.2 ft./sec.).
Max. safe speed 225 km.h. (140 m.p.h.).



Two views of the Neiva BN-1 Sailplane.

THE NEIVA B-2 MONITOR.

TYPE.—Two-seat medium-performance Sailplane.

WINGS.—Braced high-wing monoplane. Wing section Goettingen 535. Aspect ratio 13.67. Mean chord 1.343 m. (4 ft. 4¾ in.). Dihedral 0° 30′. Incidence (at root) 3°. Single box-spar with plywood-covered torsion-resistant leading-edge. Fabric-covering aft of spar. Normal type wood-framed fabric-covered ailerons. Wood spoiler type flaps. Areas: spoiler flaps 0.315 m.² (3.38 sq. ft.), ailerons (2) 3.124 m.² (33.61 sq. ft.). Gross wing area 18.40 m.² (198 sq. ft.).

FUSELAGE.—Semi-monocoque all-wood structure with steel-tube frames to support wing attachments.

TAIL UNIT.—Semi-cantilever monoplane type. Wood framework with fabric covering. Areas: fin 0.30 m.² (3.23 sq. ft.), rudder 1.32 m.² (14.20 sq. ft.), tailplane 1.30 m.² (13.98 sq. ft.), elevators 3.00 m.² (32.28 sq. ft.). Tailplane span 3.32 m. (10 ft. 11½in.).

LANDING GEAR.—Front skid and single Goodyear wheel aft of C.G.

ACCOMMODATION.—Cockpit seats two in tandem. Luggage compartment between pilots. Can be flown solo from front seat only.

DIMENSIONS.—
Span 15.86 m. (52 ft.).
Length 7.10 m. (23 ft. 3½ in.).
Height 1.13 m. (3 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 210 kg. (462 lb.).
Disposable load 150 kg. (330 lb.).
Weight loaded 360 kg. (792 lb.).
Wing loading 19.5 kg./m.² (3.99 lb./sq. ft.).

PERFORMANCE.—
Stalling speed 52 km.h. (32.3 m.p.h.).
Best gliding speed 67 km.h. (41.6 m.p.h.).
Max. safe speed 145 km.h. (90 m.p.h.).
Best gliding ratio 1 : 21.



The Neiva B-2 Monitor Two-seat Sailplane.

OMAREAL

OFICINA DE MANUTENÇÃO E RECUPERAÇÃO DE AVIOES, LTDA.

HEAD OFFICE AND WORKS: BOTUCATÚ, STATE OF SÃO PAULO.

This company took over flight testing and production of the Casmuniz 52 twin-engined five-seat cabin monoplane, the prototype of which was designed and built by Cassio Muniz S.A., of São Paulo.

THE CASMUNIZ 52.

TYPE.—Twin-engined Five-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 9.18. Chord 1.80 m. (5 ft. 11 in.) at root, 0.85 m. (2 ft. 9 in.) at tip. Dihedral 6°. Incidence 2° at root, —½° at tip. All-metal structure, with all-metal ailerons and flaps. Total area of ailerons 0.866 m.² (9.32 sq. ft.). Total area of flaps 2.482 m.² (26.72 sq. ft.). Gross wing area 19.26 m.² (207.31 sq. ft.).

FUSELAGE. — All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. All controls (including aileron controls) are by duralumin tubes supported at joints and articulations by roller bearings. All trim-tabs are positioned electrically by toggle switches on pilot's

panel. Areas: fin 0.90 m.² (9.69 sq. ft.), rudder 0.81 m.² (8.72 sq. ft.), elevators 1.806 m.² (19.44 sq. ft.), tailplane 2.27 m.² (24.43 sq. ft.). Tailplane span 4.21 m. (13 ft. 9½ in.).

LANDING GEAR.—Tail-wheel type with retractable main wheels and non-retractable tail-wheel. Oleo-pneumatic shock-absorbers. Electrical retraction. Goodyear wheels and brakes. Wheel track 3.0 m. (9 ft. 10 in.). Wheelbase 5.287 m. (17 ft. 4 in.).

POWER PLANT.—Two 185 h.p. Continental E185-11 six-cylinder horizontally-opposed air-cooled engines. Hartzell Model HC-12×20-7c two-blade controllable two-position metal airscrews. Fuel in two wing tanks each with a capacity of 160 litres (35.2 Imp. gallons). Total oil capacity 28 litres (6.16 Imp. gallons).

ACCOMMODATION.—Cabin seats pilot and four passengers, with pilot and one passenger in front and three passengers on cross bench at rear of cabin. Dual controls. Entrance door on port side. Controlled ventilation. Baggage compartment behind cabin with outside access door.

DIMENSIONS.—
Span 13.3 m. (43 ft. 8 in.).
Length 8.0 m. (26 ft. 3 in.).
Height 3.5 m. (11 ft. 6 in.).



The Casmuniz 52 (two 185 h.p. Continental E185 engines).

WEIGHTS.—
Weight empty, including oil 1,280 kg. (2,822 lb.).
Max. payload 375 kg. (827 lb.).
Payload for 4 hr. 20 min. endurance 234 kg. (516 lb.).
Weight loaded 1,750 kg. (3,858 lb.).

PERFORMANCE.—
Max. speed 314 km.h. (195 m.p.h.).
Max. cruising speed 282 km.h. (175 m.p.h.).
Stalling speed (power on, flaps and landing gear down) 96.5 km.h. (60 m.p.h.).
Landing speed 113 km.h. (70 m.p.h.).
Rate of climb at S/L. 460 m./min. (1,500 ft./min.).
Service ceiling 6,100 m. (20,000 ft.).
Take-off distance 200 m. (655 ft.).
Landing distance 300 m. (985 ft.).
Range 1,200 km. (750 miles).

THE BRITISH COMMONWEALTH

GREAT BRITAIN

ARMSTRONG WHITWORTH

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD.

HEAD OFFICE: BAGINTON, NEAR COVENTRY, WARWICKSHIRE.

WORKS: BAGINTON AND WHITLEY, NEAR COVENTRY, AND BITTESWELL, LUTTERWORTH, NEAR RUGBY.

Directors: Sir Frank Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman); Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; H. M. Woodhams, C.B.E., F.R.Ae.S., M.I. Prod.E. (Managing Director); Henry R. Watson, B.Sc., A.F.R.Ae.S. (Technical Director); John Lloyd, F.R.Ae,S.; W. S. D. Lockwood, O.B.E., A.F.R.Ae.S., M.I.Prod.E. (Works Director and General Manager); C. S. Emery (Sales Director).

Chief Designer: Edward D. Keen, B.Sc., F.R.Ae.S.

Secretary: F. D. Stallabrass.

Sir W. G. Armstrong Whitworth Aircraft, Ltd. was formed in 1921 and since 1935 has been a member of the Hawker Siddeley Group.

In 1949 Armstrong Whitworth assumed responsibility for the development and production of a two-seat night fighter version of the Gloster Meteor to specification F.24/48 and four successive versions, the Marks 11-14, were developed and produced in quantity for the Royal Air Force. The Meteor night fighter was also supplied to the air forces of Belgium, Denmark and France. Although still in service in the R.A.F. it is no longer in production. A full description of the Meteor two-seat night fighter has appeared in previous editions of "All the World's Aircraft."

In 1953 Armstrong Whitworth was entrusted with the development, design and production of the Hawker Sea Hawk. Apart from production for the Royal Navy, Armstrong Whitworth received in 1956 a U.S. "off-shore" contract for a quantity of Sea Hawks and spares for NATO, and, more recently, direct contracts from the Netherlands and German governments for the supply of Sea Hawks for service in the Dutch and German Navies.

Early in 1957 Armstrong Whitworth announced that it was re-entering the civil aircraft market with the AW.650, a general purpose freight/coach type aircraft powered in its basic form by four Rolls-Royce Dart turboprop engines. Initially, ten AW.650's are being built, the first of which is due to fly in October, 1958.

THE ARMSTRONG WHITWORTH AW.650.

The AW.650 has been designed specifically to meet the requirements for a large-capacity civil and military passenger and freight transport for worldwide service. A production series of ten of the basic version has been laid down as a private venture and the first of these is due to fly in October, 1958; but the design can be adapted to fulfil a variety of rôles, and the following variants have been offered for subsequent production.

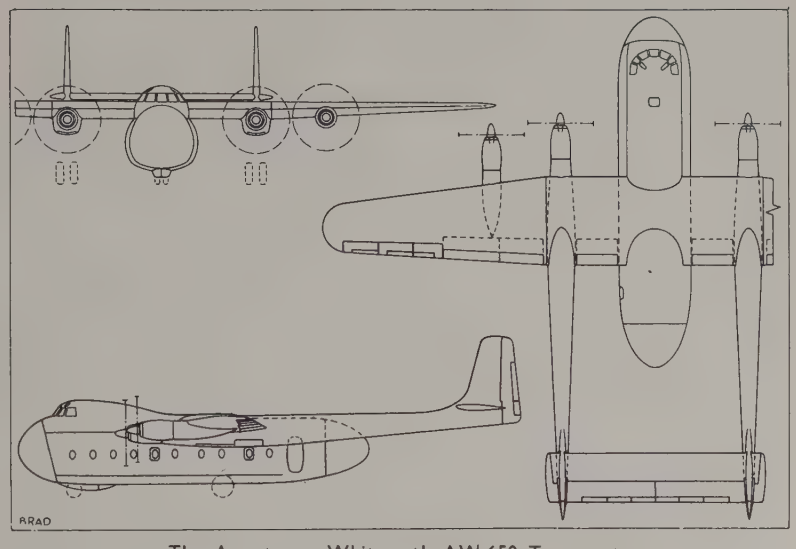
AW.650. Basic freighter/coach version now in production. Four Rolls-Royce Dart turboprops. Pressurised.

AW.651. Development of AW.650 with two Rolls-Royce Tyne turboprops. Pressurised.

AW.660. Military transport. Four Rolls-Royce Darts. Pressurised.

AW.661. Variant of AW.660 with two Rolls-Royce Tynes. Pressurised.

AW.670. Car ferry version, able to accommodate six cars and 30 passengers on two decks. Fuselage 14 ft. 6 in. (4.42 m.) wide to take two cars abreast. Four Rolls-Royce Darts. Unpressurised.



The Armstrong Whitworth AW.650 Transport.

AW.671. High-density "airbus" with accommodation for 120-130 passengers. Wide fuselage as AW.670. Four Rolls-Royce Darts. Unpressurised.

The following details apply to the basic AW.650 version.

TYPE.—Four-engined Passenger and Freight Transport.

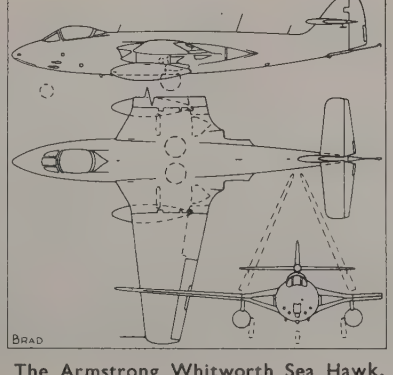
WINGS.—Shoulder-wing cantilever monoplane, based on the wing of the Avro Shackleton. Wing section NACA 23018 (modified) at root, NACA 23012 at tip. Aspect ratio 9.12. Mean chord 12 ft. 7.3 in. (3.84 m.). Dihedral 0° on centre section, 2° on outer wings. Incidence 4°. All-metal two-spar structure. All-metal internally-balanced ailerons. All-metal double-slotted flaps. Total area of ailerons 77 sq. ft. (7.15 m.²). Total area of flaps 210 sq. ft. (19.51 m.²). Gross wing area 1,450 sq. ft. (134.7 m.²).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type, with twin fins and rudders, carried on elliptical section metal tail booms. Areas: fins 250 sq. ft. (23.23 m.²), rudders 66 sq. ft. (6.13 m.²), tailplane 326 sq. ft. (30.28 m.²), elevators 107 sq. ft. (9.94 m.²). Tailplane span 38 ft. 6 in. (11.73 m.).

LANDING GEAR.—Retractable tricycle type. Dowty oleo-pneumatic shock-absorbers. Twin Dunlop wheels on all units. Dunlop Maxaret anti-skid brakes. Wheel track 32 ft. 6 in. (9.90 m.). Wheelbase 25 ft. 5 in. (7.75 m.).

POWER PLANT.—Four Rolls-Royce Dart Mk. 526 turboprop engines, each developing 1,910 h.p. plus 505 lb. (229 kg.) jet thrust for take-off, with maximum continuous power of 1,750 h.p. plus 445 lb. (202 kg.) jet thrust and maximum recommended cruise power of 1,460 h.p. plus 355 lb. (161 kg.) jet thrust. Rotol four-blade airscrews. Fuel in ten bag-type tanks between wing spars, two of 362 Imp. gallons, two of 463 Imp. gallons, two of 405 Imp. gallons, two of 320 Imp. gallons and two of 100 Imp. gallons. Total fuel capacity 3,300 Imp. gallons (15,000 litres).



The Armstrong Whitworth Sea Hawk.

ACCOMMODATION.—Crew of two or three on raised flight deck above main cabin, which is 47 ft. long, 11 ft. 8 in. (maximum) wide and 8 ft. 9 in. (maximum) high (14.33 × 3.55 × 2.67 m.). Volume of cabin 3,680 cub. ft. (104.2m.³). Seats for 77 passengers, or various combinations of passengers and freight, or all freight. Flight deck and main cabin pressurised to differential of 5.5 lb./sq. in. (0.39 kg./cm.²). Clamshell loading doors at front and rear of cabin, 6 ft. 8 in. high and 8 ft. 8 in. wide (2.03 × 2.64 m.).

DIMENSIONS.—
Span 115 ft. (35.05 m.).
Length 86 ft. 9 in. (26.44 m.).
Height 27 ft. (8.23 m.).

WEIGHTS.—
Weight empty, equipped 39,850 lb. (18,090 kg.).
Max. payload 28,000 lb. (12,712 kg.).
Payload with max. fuel 15,400 lb. (6,992 kg.).
Weight loaded 82,000 lb. (37,195 kg.).
Wing loading at T.O. weight 56 lb./sq. ft. (273.3 kg./m.²).
Power loading at T.O. weight 9.76 lb./e.h.p. (4.43 kg./e.h.p.).

PERFORMANCE (estimated).—
Max. cruising speed at 25,000 ft. (7,620 m.) 296 m.p.h. (476 km.h.).
Economic cruising speed at 25,000 ft. (7,620 m.) 280 m.p.h. (448 km.h.).
Rate of climb at S/L. 1,400 ft./min. (425 m./min.).
Take-off distance to 50 ft. (15.25 m.) 3,050 ft. (930 m.).
Landing distance from 50 ft. (15.25 m.) 2,280 ft. (695 m.).

RANGES (estimated).—
Max. range with 15,400 lb. (6,992 kg.) payload: 3,000 miles (4,800 km.) at 280 m.p.h. (448 km.h.) at 25,000 ft. (7,620 m.).
With max. payload (28,000 lb. = 12,712 kg.): 1,460 miles (2,340 km.) at 280 m.p.h. (448 km.h.) at 25,000 ft. (7,620 m.).

THE SEA HAWK

The Sea Hawk was designed and the initial production was undertaken by Hawker Aircraft Ltd. The development and production of this aircraft has been the responsibility of Sir W. G. Armstrong Whitworth Aircraft Ltd. since mid-1953.



The Armstrong Whitworth Sea Hawk F. (G.A.) Mk. 6 Naval Fighter Bomber (Rolls-Royce Nene engine).

The following versions of the Sea Hawk have been announced :—

Sea Hawk F. Mk. 1. Rolls-Royce Nene 101 turbojet engine (5,000 lb. = 2,270 kg. s.t.). Spring-tab ailerons. Initial production of Mk. 1 by Hawker Aircraft, Ltd. but transferred to Armstrong Whitworth in 1953.

Sea Hawk F. Mk. 2. Similar to Mk. 1 but with powered ailerons.

Sea Hawk F.B. Mk. 3. Fighter-bomber version of F. Mk. 2. Wings stressed for under-wing stores such as rockets, bombs, etc.

Sea Hawk F. (G.A.) Mk. 4. The Mk. 3 adapted for a change of rôle.

Sea Hawk F.B. Mk. 5. Similar to Mk. 3, but with up-rated Nene 103 turbojet (5,400 lb. = 2,450 kg. s.t.).

Sea Hawk F. (G.A.) Mk. 6. Similar to Mk. 4 but with up-rated Nene 103 turbojet (5,400 lb. = 2,450 kg. s.t.).

Sea Hawk Mk. 50. For Royal Netherlands Navy. Differs from Mk. 6 in having American radio equipment. 22 ordered.

Sea Hawk Mk. 100. For German Navy. Differs from Mk. 6 in having American radio equipment and provision for carrying four L/R underwing fuel tanks. Also has increased fin and rudder area.

Sea Hawk Mk. 101. For German Navy. As Mk. 100 but with additional electronic equipment. Total of 68 Mk. 100 and Mk. 101 ordered.

The description below refers particularly to the Sea Hawk F. (G.A.) Mk. 6.

TYPE.—Single-seat Naval Fighter.

WINGS.—Cantilever mid-wing monoplane. All-metal structure with stressed heavy-gauge skin. Outer wings attached to stub wings by two hinge fittings with automatic locks and a spigot bearing in the leading-edge, and are power-folded. All-metal power-operated ailerons with spring tabs. Combined hydraulically-operated landing and brake flaps of double split type inboard of ailerons. Gross wing area 278 sq. ft. (25.8 m.²). Flap area 50 sq. ft. (4.5 m.²). Aspect ratio 5.5. Dihedral root to tip 4½ degrees. Incidence + ½ degree.

FUSELAGE.—All-metal structure. Nose and centre portions are of semi-monocoque construction reinforced by a box-section keel member and four longerons ; the rear portion is a pure monocoque of which the fin base is an integral part. Fuselage is stressed for tail-down accelerated take-offs : single catapult take-off point beneath fuselage.

TAIL UNIT.—All-metal cantilever structure. Tailplane, of one-piece multi-spar construction, passes through fin above fuselage. Controllable trim-tabs in elevators. Total horizontal area 38.6 sq. ft. (3.59 m.²). Total vertical area 33.1 sq. ft. (3.04 m.²).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Dowty liquid-spring shock-absorber struts to all wheels. Sting-type arrester hook in rear fuselage. Track 8 ft. 6 in. (2.6 m.).

POWER PLANT.—One Rolls-Royce Nene 103 turbojet engine in centre fuselage. Air intakes in wing leading-edge roots, bifurcated tail-pipe with exits in wing trailing-edge root fairings, one each side of fuselage. Spring-loaded doors in top surface of centre fuselage provide additional air intakes when the engine is ground running and for take-off. As pressure in the plenum chamber increases these doors close automatically. Fuel tanks in fuselage, with provision for under-wing drop tanks.

ACCOMMODATION.—Pilot in pressurised cockpit well forward in nose of fuselage, with three-piece windscreen, including an optically-flat bullet-proof centre section, and single-piece jettisonable canopy. Martin-Baker ejector seat for pilot. Canopy can be jettisoned in conjunction with seat or by itself.

ARMAMENT. Four 20 mm. cannon mounted in lower portion of fuselage nose. Provision for bombs or rocket projectiles on under-wing racks in Mks. 3 4, 5 and 6.

DIMENSIONS.—
Span 39 ft. (11.9 m.).
Width folded 13 ft. 4 in. (4.04 m.).
Length 39 ft. 7 in. (12.1 m.).
Height 8 ft. 8 in. (2.65 m.).
Height (wing folded) 16 ft. 10 in. (5.1 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Armstrong Whitworth Sea Hawk Mk. 100/101 Naval Fighter (Rolls-Royce Nene engine).

AUSTER

AUSTER AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: REARSBY AERODROME, REARSBY, LEICESTER.

Directors: F. Bates (Managing Director), P. Wykes (Chairman), A. J. Pickering, K. Sharp, F. A. Pratley, F.C.A., E. C. Harrison.

Chief Designer: R. E. Bird.

Auster Aircraft, Ltd. was formed in 1939 to manufacture light aircraft and assumed its present title on March 7, 1946. Throughout the last war many military A.O.P. aircraft were built, providing the company with considerable experience in the design of light aircraft to be operated by the Army.

Many of these aircraft, particularly of the Auster Mk. 5, 6 and 7 series, are still in military and civil use throughout the world. Full descriptions of them have appeared in earlier editions of this annual.

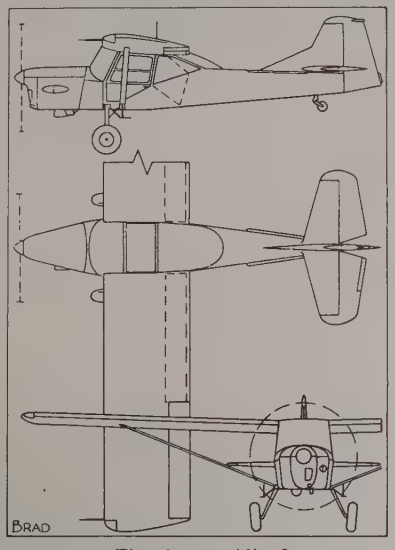
Auster's latest A.O.P. aircraft, the Mk. 9 is in full production. The first Mk. 9 made its first flight on March 19, 1954, and deliveries to the services began on February 11, 1955. Mk. 9's have also been supplied to the Indian Army and the Indian and South African Air Forces.

Auster aircraft in current production include various versions of the Autocar, Aiglet Trainer, Alpha and Alpine civil series, plus the Auster Mk. 9, and the Agricola. A complete break-away from conventional Auster types, the Agricola has been designed initially as a top-dressing (aerial fertilizing) aircraft for New Zealand. However, it is equally suitable for spraying, dusting, aerial baiting, fence dropping and aerial seeding. In addition, the new four-seat Atlantic is under development.

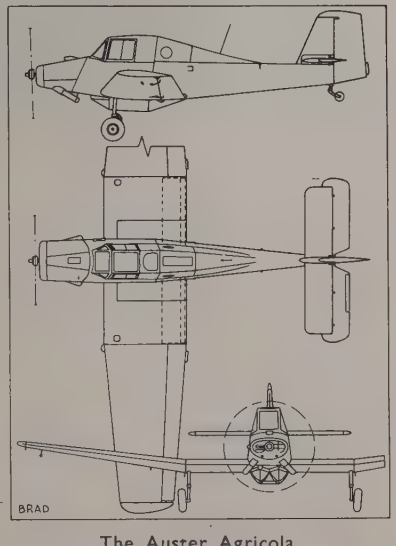
Most three-or four-seat civil Austers can be fitted with equipment for crop-dusting and spraying, cable-laying, glider-towing, banner-towing, aerial advertising, air-to-ground broadcasting, aerial photography and air ambulance duties. Skis and cross-wind landing wheels are also approved for fitment to Austers, and those types with engines of 130 h.p. or more can be fitted with floats. All three-seaters can have a double rear seat fitted to convert them into occasional four-seaters.



The Auster Mk. 9 (173 h.p. Cirrus Bombardier engine).



The Auster Mk. 9.



The Auster Agricola.

THE AUSTER Mk. 9.

TYPE.—Three-seat Air Observation Post and Light Communications monoplane.

WINGS.—High-wing braced monoplane. NACA 23012 wing section. Chord 5 ft. 6 in. (1.67 m.). Dihedral 2°. Structure comprises one built-up metal I-type main spar, pressed metal nose ribs, tubular leading-edge and pre-formed sheet metal D-section skin to form torsion box; and, aft of spar, pressed light alloy ribs covered with fabric. Moulded Durestos wing-tips. Each wing braced to fuselage by single extruded light alloy strut. Metal-framed, fabric-covered slotted ailerons droop automatically when split flaps are lowered. Maximum aileron droop 10°. Flap settings 22° for take-off, 50° for landing. Gross wing area 197.6 sq. ft. (18.36 m.²).

FUSELAGE.—Warren-type welded steel tube structure covered with fabric aft of front door hinge post.

TAIL UNIT.—Cantilever monoplane type. Stressed skin construction, the skins of all surfaces being reinforced by Redux-ed internal chordwise stiffeners. Moulded Durestos tip to rudder forms horn balance. Ground-adjustable tab in rudder, controllable trim-tab in port elevator.

LANDING GEAR.—Fixed tail-wheel type. Single forged legs pivoted near upper ends and sprung by Dowty liquid-spring shock absorbers mounted horizontally within box-section extruded shock truss extending across fuselage between landing-gear pick-up points. Goodyear wheels, low-pressure tyres and toe-operated hydraulically-operated single-disc brakes. Fully-castoring levered-suspension tail-wheel unit with Dowty liquid-sprung shock-absorber. Track: 6 ft. 8 in. (2.0 m.).

POWER PLANT.—One Cirrus Bombardier 203 four-cylinder in-line inverted air-cooled engine rated at 173 h.p. on M.T. fuel. Plessey cartridge type starter. Fairey-Reed fixed-pitch metal airscrew. Main fuel in Marston Excelsior bag-type tank in starboard wing root. Normal fuel capacity 16 Imp. gallons (72.6 litres). For longer range corresponding tank may be fitted in port wing root, and for ferrying an auxiliary tank can be installed in rear fuselage.

ACCOMMODATION.—Seating for three in enclosed cabin. Pilot and passenger side-by-side. Observer at rear may face forward or aft. One door on port side, two on starboard side, all fitted with jettison gear.

EQUIPMENT.—Four 4-in. flares can be carried on standard light bomb carrier under fuselage for flare-dropping duties.

DIMENSIONS.—
Span 36 ft. 5 in. (11.22 m.).
Length 23 ft. 8½ in. (7.23 m.).
Height (on ground) 8 ft. 11 in. (2.7 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,460 lb. (663 kg.).
Weight loaded (normal A.O.P. operational load including pilot, observer, two radios, full fuel load, etc.) 2,100 lb. (953 kg.).
Wing loading 10.4 lb./sq. ft. (50.75 kg./m.²).
Power loading 11.9 lb./h.p. (5.39 kg./h.p.).

PERFORMANCE (at 2,100 lb. = 953 kg. A.U.W.).
Max. speed 127 m.p.h. (204 km.h.).
Normal cruising speed 110 m.p.h. (178 km.h.).
Initial rate of climb 920 ft./min. (280 m./min.).
Absolute ceiling 18,500 ft. (5,650 m.).
Range at economic cruise 242 miles (400 km.).
Take-off run in 6 m.p.h. (9.3 km.h.) wind 810 yds. (99 m.).
Take-off to clear 50 ft. (15.25 m.) in 6 m.p.h. (9.3 km.h.) wind 210 yds. (192 m.).
Landing run 60 yds. (55 m.).
Landing distance from 50 ft. (15.25 m.) in 6 m.p.h. (9.3 km.) wind 150 yds. (137 m.).



The Auster Agricola (240 h.p. Continental O-470 engine).

THE AUSTER B.8 AGRICOLA

TYPE.—Single-engined Agricultural monoplane.

WINGS.—Low-wing cantilever monoplane. Centre section aerofoil NACA 43018. Outer wing airofoil at tip NACA 23012. Chord 7 ft. (2.13 m.) at root, 4 ft. 3¼ in. (1.30 m.) at tip. Dihedral 7° on outer wings. Metal two-spar structure, with metal covered leading-edge which forms a torsion box on outer wings. Fabric-covering aft of front spar, except for small portion at root of outer wings which is metal-covered to withstand drag loads. Slotted ailerons have metal structure with fabric-covering. Double split flaps have metal structure and metal covering, and are hydraulically operated. Gross wing area 254.7 sq. ft. (23.68 m.²).

FUSELAGE.—Welded steel tube structure, fabric-covered aft of hopper filling trunk,



The Auster Agricola (240 h.p. Continental O-470 engine).

TAIL UNIT.—Cantilever monoplane type. All metal structure with fabric covering. Ground adjustable trim-tab on rudder. Controllable trim-tab on port elevator. Area of tailplane and elevator 45.01 sq. ft. (4.18 m.²). Tailplane span 14 ft. 1½ in. (4.31 m.).

LANDING GEAR.—Fixed tail-wheel type. Interchangeable Electro-Hydraulics main wheel oleo units specially designed to withstand continuous rough landings. Goodyear wheels, tyres and disc brakes. Tyres 8.50-6. Oleo-type tailwheel, with 10 in. (25.4 cm.) tyre. Wheel track 14 ft. 4 in. (4.37 m.). Wheelbase 19 ft. (5.79 m.).

POWER PLANT.—One 240 h.p. Continental O-470-M2 six-cylinder horizontally-opposed air-cooled engine, driving a controllable-pitch McCauley Met-L-Matic 2A36C1-4 airscrew. Fuel tank with 24 Imp. gallons (109 litres) capacity in port wing root. Oil capacity 2.5 Imp. gallons (11.4 litres).

ACCOMMODATION.—Enclosed single-seat cabin for pilot situated well forward for good visibility. Side-by-side two-seat cabin just aft of hopper trunk with rearward facing bench-type seat. Hopper for 1,680 lb. (762 kg.) dust below pilot with two pairs of hydraulically-operated doors permitting emergency dumping of load in only 5 seconds. Spray tanks in centre-section have total capacity of 144 Imp. gallons (654 litres). Spray booms inside wings with only nozzles projecting.

DIMENSIONS.—
Span 42 ft. (12.80 m.).
Length 27 ft. 6 in. (8.38 m.).
Height 8 ft. 4 in. (2.53 m.).

WEIGHTS.—
Weight loaded with 1,400 lb. (635 kg.) payload 3,675 lb. (1,663 kg.).
Weight loaded with 1,680 lb. (762 kg.) payload 3,810 lb. (1,728 kg.).

PERFORMANCE (at 3,675 lb.=1,663 kg. A.U.W.).—
Max. cruising speed 123 m.p.h. (198 km.h.).
Normal cruising speed 111 m.p.h. (179 km.h.).
Economical cruising speed at 3,000 ft. (915 m.) 101 m.p.h. (163 km.h.).
Stalling speed (flaps down) 44 m.p.h. (71 km.h.).
Rate of climb at S/L. 790 ft./min. (240 m./min.).
Service ceiling 10,500 ft. (3,200 m.).
Take-off run, short grass 510 ft. (155 m.).
Take-off distance to clear 20 ft. (6 m.) 870 ft. (265 m.).
Landing run 435 ft. (132 m.).
Landing distance from 20 ft. (6 m.) 945 ft. (290 m.).
Max. range 218 miles (350 km.).

THE AUSTER ATLANTIC.

The Atlantic is a completely new design, with a tricycle landing gear and equipped and furnished to a much higher standard than any previous Auster type. Intended for private owner or business "executive" use, it is a four-seater, powered by a 205 h.p. Continental E185-10 six-cylinder horizontally-opposed air-cooled engine.

The cabin is sound-proofed, air-conditioned and fully-upholstered, with carpet on the floor. Key-type ignition, glove compartments, ash-trays, tailored travel cases and cigar lighter are standard, with provision for extensive radio and blind-flying instruments. Equipment includes flaps, hydraulic wheel-brakes, wheel spats, parking brake, steerable nose-wheel, metal variable-pitch airscrew and dual controls.

Two versions of the Atlantic are under development :—

Windsor de luxe. Fully-equipped standard version, as described above. Prototype, scheduled to fly late in 1957, is of this type.

Winchester. Basically as Windsor de luxe, but less extensively equipped and without radio and blind-flying instruments.

PERFORMANCE (estimated).—
Cruising speed up to 135 m.p.h. (217 km.h.).
Landing speed 50-55 m.p.h. (80-89 km.h.).
Rate of climb at S/L 800-1,150 ft./min. (245-350 m./min.).
Take-off distance, zero wind, 135-225 yards (123-206 m.).
Landing distance, zero wind, 130 yards (119 m.).
Range at 124 m.p.h. (200 km.h.) with 610 lb. (277 kg.) payload 440 miles (710 km.).



The Auster Alpha 5 (130 h.p. Lycoming O-290 engine).

THE AUSTER ALPHA.

The Alpha has been produced to meet the need for a really low-price light aircraft capable of a variety of duties in varied climatic conditions. It is available in two versions :—

J1N Alpha. With 130 h.p. de Havilland Gipsy Major 1 engine.

Alpha 5. With 130 h.p. Lycoming O-290-3/1 engine.

Both versions are being delivered as completely new aircraft by the manufacturers ; but many owners of Auster J1 Autocrats are also bringing their aircraft virtually to J1N Alpha standard by fitting the more powerful Gipsy Major engine and a new tail unit with horn-balanced rudder.

There are two individual front seats, with dual controls as standard equipment, and a bench-type rear seat for one adult or two children. Optional equipment includes a light stretcher unit, fittings for crop-spraying or air photography and, in the Lycoming-engined version, fittings for glider and banner towing. The wheels can be exchanged for skis or floats, and the Lycoming-powered floatplane is able to carry a full load of three persons and 15 Imp. gallons (68 litres) of fuel.

PERFORMANCE (either engine, with 2 persons and 15 Imp. gallons=68 litres fuel).—
Max. cruising speed 108 m.p.h. (174 km.h.).
Rate of climb at S/L. 950 ft./min. (290 m./min.).



The Auster J1N Alpha (130 h.p. D.H. Gipsy Major engine).

Take-off run in 5 m.p.h. (8 km.h.) wind under 300 ft. (91 m.).
Take-off distance to 50 ft. (15.25 m.) in 5 m.p.h. (8 km.h.) wind 675 ft. (206 m.).
Landing run in 5 m.p.h. (8 km.h.) wind 315 ft. (96 m.).
Landing distance from 50 ft. (15.25 m.) in 5 m.p.h. (8 km.h.) wind 900 ft. (275 m.).

THE AUSTER J.5F AIGLET TRAINER.

The Aiglet Trainer is a two-seat dual-control aerobatic training aircraft which has been designed to fulfil present-day training requirements and to provide maximum usage at lowest cost. The airframe is basically similar to the earlier J.5, but the Aiglet Trainer has horn-balanced rudder and elevators and the wings have been clipped by 4 ft. (1.22 m.) to give a greater rate of roll. The side-by-side seats are designed to conform to the aircraft's aerobatic category and the fuselage width has been increased by 4 in. (10.16 cm.) to give a wider cabin than usual in Auster types.

The J.5F can also be supplied as a three-seat tourer, in which case the aerobatic seats are replaced by standard Auster front seats. The seat for the rear passenger is of the wide forward-facing type.

TYPE.—Two-seat Aerobatic Trainer or three-seat Touring monoplane.

WINGS.—Strut-braced high-wing monoplane. Incidence (root) 3¾ degrees, (tip) 2½ degrees ; dihedral 1 degree ; chord 5 ft. 3 in. (1.60 m.). Wing braced by streamlined steel-tube V-struts on each side. Structure consists of laminated spruce spars, ribs of

drawn-section light alloy, steel drag struts and tie-rod internal bracing, metal leading-edge and an overall fabric covering. Ailerons have wooden spars, light alloy nose and ribs and fabric covering. Manually-operated split trailing-edge flaps have steel torsion shaft and light alloy skin. Gross wing area 164 sq. ft. (15.24 m.²).

FUSELAGE.—Rectangular-section welded steel-tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework with fabric covering. Fixed tailplane. Horn-balanced rudder and elevators. Rudder has trim-tab adjustable on ground. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.).

LANDING GEAR.—Fixed tail-wheel type. Half-axles sprung under centre-line of fuselage with rubber-cord shock-absorbers. Dunlop wheels and Bendix brakes. Track 6 ft. 0 in. (1.83 m.). Full-castoring tail-wheel on leaf-spring with solid rubber tyre.

POWER PLANT.—One 130 h.p. D.H. Gipsy Major 1 four-cylinder in-line inverted air-cooled engine. Fairey-Reed metal air-screw. Fuel tank with 16 Imp. gallon (72.5 litre) capacity in starboard wing root. Provision for similar tank in port wing for long-range flying.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls, with seat for third person in rear of cabin when aircraft is used for touring. One-piece moulded Perspex wind-shield and moulded cabin roof. Access door on each side with sliding windows.

DIMENSIONS.—
Span 32 ft. (9.76 m.).
Length 23 ft. 2½ in. (7.07 m.).
Height 8 ft. 3 in. (2.52 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,323 lb. (601 kg.).
Weight loaded (Aerobatic two-seater) 1,950 lb. (885 kg.).
Weight loaded (three-seat Tourer) 2,200 lb. (1,000 kg.).
Wing loading 13.45 lb./sq. ft. (65.63 kg./m.²).
Power loading 16.9 lb./h.p. (7.67 kg./h.p.).

PERFORMANCE.—
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (engine off, full flap) 29 m.p.h. (46.4 km.h.).
Initial rate of climb 705 ft./min. (215 m./min.).
Take-off run (still air) 172 yds. (157 m.).
Cruising range (one tank) 275 miles (440 km.).
Max. cruising range (two tanks) 545 miles (872 km.).

THE AUSTER AUTOCAR.

The four-seat Autocar is the most versatile of the Auster civil types, and can be used for freighting, spraying, dusting, glider towing and ambulance duties, as well as passenger-carrying.

It has tail surfaces of greater area than earlier Auster designs, with horn-balanced rudder. In addition, its cabin is deeper, with a characteristic "hump" in side elevation.

There are three versions, the J5B (named Autocar) with 130 h.p. Gipsy Major 1 engine; the J5G (named Cirrus Autocar) with Cirrus Major 3 engine; and the J5P (named Autocar 145) with Gipsy Major 10 engine.

TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing strut-braced monoplane. Incidence (root) 3¾°, (tip) 2½°.



The Auster Aiglet Trainer (130 h.p. D.H. Gipsy Major 1 engine).

Dihedral 1°. Chord 5 ft. 3 in. (1.60 m.). Wing braced by streamlined steel-tube V-struts on each side. Structure consists of laminated spruce spars, ribs of drawn-section light alloy, steel drag struts and tie-rod internal bracing, metal leading-edge with an overall fabric covering. Ailerons have wooden spars, light alloy nose and ribs with fabric covering. Manually-operated split trailing-edge flaps have steel torsion shaft and light alloy skin. Total aileron area 18 sq. ft. (1.66 m.²). Total flap area 16 sq. ft. (1.47 m.²). Gross wing area 185 sq. ft. (17.14 m.²).

FUSELAGE.—Rectangular section welded steel tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel framework with fabric covering. Fixed tailplane. Rudder has trim-tab, adjustable on the ground and is horn-balanced. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.). Gross tailplane area 24.72 sq. ft. (2.28 m.²). Fin area 5.1 sq. ft. (0.47 m.²). Rudder area 10.1 sq. ft. (0.93 m.²).

LANDING GEAR.—Fixed tail-wheel type. Half-axles sprung under centre-line of fuselage with rubber-cord shock-absorbers. Dunlop wheels and Bendix brakes. Track 6 ft. 0 in. (1.83 m.). Full-castoring tail-wheel on leaf-spring with solid conductive rubber tyre.

POWER PLANT.—One 130 h.p. Gipsy Major 1 (J.5B) or 155 h.p. Cirrus Major 3 (J.5G) or 145 h.p. Gipsy Major 10 (J.5P) four-cylinder in-line inverted air-cooled engine. Silencer and metal Fairey-Reed airscrew are standard. Fuel tanks in each wing root, total capacity 32 Imp. gallons (145 litres). Oil tank, capacity 3 gallons (13.6 litres) aft of engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side, with dual controls if required, and two side-by-side at rear of cabin. Backs of front seats hinge forward for access to rear. Luggage space aft of rear seat. One access door in each side with sliding windows.

DIMENSIONS.—
Span 36 ft. 0 in. (11.0 m.).
Length 23 ft. 2 in. (7.1 m.).
Height 7 ft. 6 in. (2.3 m.)

WEIGHTS AND LOADINGS (J.5B Gipsy Major 1 engine).—
Weight empty 1,413 lb. (640 kg.).
Weight loaded 2,400 lb. (1,089 kg.).
Wing loading 13 lb./sq. ft. (63 kg./m.²).
Power loading 18.5 lb./h.p. (8.25 kg./h.p.).

WEIGHTS AND LOADINGS (J.5G Cirrus Major 3 engine).—
Weight empty 1,367 lb. (621 kg.).
Weight loaded 2,450 lb. (1,112 kg.).
Wing loading 13.3 lb./sq. ft. (64.9 kg./m.²).
Power loading 15.8 lb./h.p. (7.17 kg./h.p.).

WEIGHTS AND LOADINGS (J.5P Gipsy Major 10 engine).
Max. weight loaded 2,450 lb. (1,111 kg.).
Power loading 16.9 lb./h.p. (7.55 kg./h.p.).
Wing loading 13.3 lb./sq. ft. (65 kg./m.²).

PERFORMANCE (J.5B Gipsy Major 1 engine).—
Max. speed 116 m.p.h. (186 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed (flaps down) 34 m.p.h. (55 km.h.).
Stalling speed (flaps up) 42 m.p.h. (67.6 km.h.).
Rate of climb 525 ft./min. (2.66 m./sec.).
Service ceiling 11,000 ft. (2,352 m.).
Absolute ceiling 13,000 ft. (3,962 m.).
Still air range 500 miles (805 km.).
Take-off run (5 m.p.h. = 8 km.h. wind) 211 yds. (192 m.).
Take-off distance to 50 ft. (15.2 m.) 537 yds. (490 m.).
Landing run (5 m.p.h. = 8 km.h. wind) 163 yds. (159 m.).

PERFORMANCE (J.5G Cirrus Major 3 engine).—
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (flaps down) 36 m.p.h. (57.6 km.h.).
Initial rate of climb 710 ft./min. (216.5 m./min.).
Service ceiling 14,000 ft. (4,270 m.).
Absolute ceiling 16,200 ft. (4,940 m.).
Still air range 485 miles (775 km.).
Take-off run (5 m.p.h. = 8 km.h. wind) 175 yds. (160 m.).
Take-off distance to 50 ft. (15.2 m.) 320 yds. (293 m.).
Landing run (5 m.p.h. = 8 km.h. wind) 130 yds. (120 m.).

PERFORMANCE (J.5P Gipsy Major 10 engine).—
Max. speed 125 m.p.h. (201 km.h.).
Cruising speed 111 m.p.h. (185 km.h.).
Stalling speed (flaps down) 36 m.p.h. (58 km.h.).
Stalling speed (flaps up) 45 m.p.h. (72.4 km.h.).
Landing speed 55 m.p.h. (89 km.h.).
Rate of climb at S/L. 620 ft./min. (189 m./min.).
Service ceiling 13,500 ft. (4,110 m.).
Absolute ceiling 16,000 ft. (4,880 m.).
Take-off run (5 m.p.h. = 8 km.h. wind) 245 yards (224 m.).
Landing run (5 m.p.h. = 8 km.h. wind) 130 yards (119 m.).
Range (still air) 425 miles (685 km.).

PERFORMANCE (J.5P Gipsy Major 10, as float-plane, A.U.W. 2,400 lb. = 1,085 kg.).—
Rate of climb at S/L. 480 ft./min. (146 m./min.).
Take-off time to unstick 44 seconds.
Take-off distance to unstick 660 yards (602 m.).
Range (still air) 181 miles (297 km.).



An Auster Autocar Seaplane (130 h.p. D.H. Gipsy Major 1 engine).

THE AUSTER ALPINE.

This civil Auster incorporates features of both the Autocar and Aiglet. Basically, it combines the wide cabin of the Aiglet Trainer with long-span Autocar wings.

TYPE.—Three-seat Cabin monoplane.

WINGS.—Similar to Autocar.

FUSELAGE.—Similar to Aiglet Trainer.

Tail Unit.—Similar to J.5G Autocar, with horn-balanced elevator. Span of tailplane and elevator increased to 11 ft. 5 in. (3.48 m.).
Landing Gear.—Similar to Autocar.
Power Plant.—One 145 h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine. Silencer and metal airscrew fitted as standard. Fuel in two tanks in wing roots, each with capacity of 16 Imp. gallons (72.5 litres).
Accommodation.—Enclosed cabin seating three persons. Dual controls and brakes provided for side-by-side front seats. Luggage space aft of rear seat.
Dimensions.—
Same as for Autocar.
Performance (A.U.W. 1,827 lb. = 829 kg. = two persons and 16 Imp. gallons = 72.5 litres fuel).
Max. speed at 4,000 ft. (1,220 m.) 124 m.p.h. (200 km.h.).
Max. cruising speed at 4,000 ft. (1,220 m.) 110 m.p.h. (177 km.h.).
Stalling speed 31 m.p.h. (50 km.h.).
Rate of climb at S/L. 1,025 ft./min. (313 m./min.).



The Auster Alpine (145 h.p. D.H. Gipsy Major 10 engine).

Ceiling 22,000 ft. (6,705 m.).
Take-off run in 5 m.p.h. (8 km.h.) wind 270 ft. (82 m.).
Take-off distance to clear 50 ft. (15.25 m.) in 5 m.p.h. (8 km.h.) wind 630 ft. (192 m.).
Max. range (still air) at 101 m.p.h. (163 km.h.) 460 miles (740 km.).
Landing run 300 ft. (92 m.).

AVIATION TRADERS

AVIATION TRADERS (ENGINEERING), LTD.

Head Office: 21, Wigmore Street, London, W.1.

Works: Southend and Stansted Airports, Essex.

Directors: F. A. Laker (Managing) and J. M. Laker.

General Manager: W. E. Brown, A.R.Ae.S.

Manager, Aircraft Division: A. I. Johnson.

Chief Designer: A. C. Leftley, A.F.R.Ae.S.

Commercial Manager: R. Edwards.

Engineering Manager: J. Wiseman.

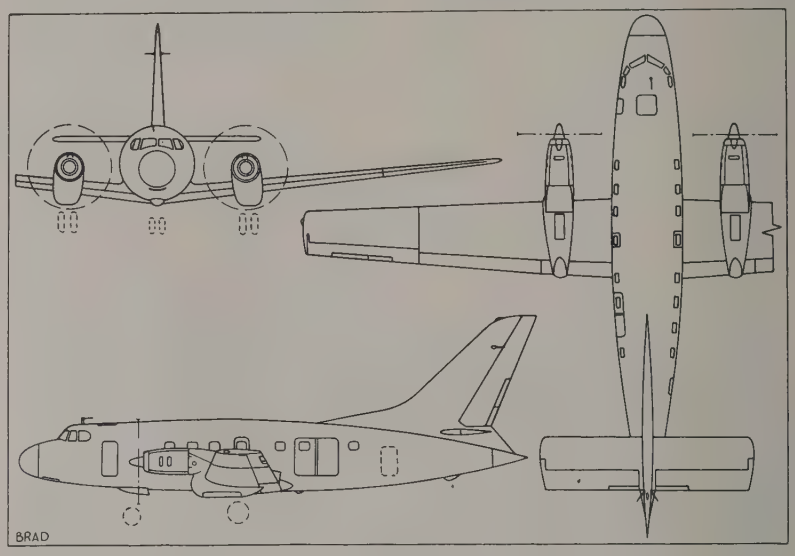
Aviation Traders (Engineering), Ltd. was formed in 1949 to undertake the overhaul and maintenance of aircraft and, in particular, to maintain the air transport fleet of its associated company Air Charter Ltd. The company has since developed into a design and manufacturing organisation, producing aircraft and aircraft components.

The first aircraft designed and built by Aviation Traders is the Accountant, which was produced in the company's works at Southend Municipal Airport. The prototype made its first flight on July 9, 1957.

THE AVIATION TRADERS ACCOUNTANT.

Two versions of the Accountant have been designed:—

ATL 90 Accountant Mark I. Long-range aircraft for executive travel or general passenger transport, with up to 28 seats. Prototype is of this version.



The Aviation Traders Accountant Mk. I Medium Transport.

ATL 91 Accountant Mark II. Basically as Mark I, but with longer fuselage accommodating up to 40 seats.

Type.—Twin-engined medium Transport designed as a replacement for the DC-3.

Wings.—Low-wing cantilever monoplane. Wing section NACA 23018 (root), NACA 4412 (tip). Aspect ratio 10.77. Mean chord 7 ft. 8 in. (2.23 m.). Dihedral 6°. Incidence 4° (root), 1° (tip). All-metal two-spar structure in five units, two of which are integral tanks. End loads in bottom surface contained in skin and stringer construction with no spar booms in tension under flight loads. Set-back hinge ailerons. Double-slotted wing flaps with central single-slotted flap under fuselage. Total area of ailerons 38.86 sq. ft. (3.61 m.²). Total area of flaps 158.8 sq. ft. (14.75 m.²). Gross wing area 632 sq. ft. (58.7 m.²).

Fuselage.— Circular section all-metal stressed-skin structure, pressurised over



The Aviation Traders Accountant Medium Transport (two 1,730 e.s.h.p. Rolls-Royce Dart turboprop engines).



The Aviation Traders Accountant Medium Transport (two 1,730 e.s.h.p. Rolls-Royce Dart turboprop engines.)

whole length at 5.5 lb./sq. in. (0.38 kg./cm.²) differential, equivalent to 8,000 ft. (2,440 m.) conditions at 25,000 ft. (7,625 m.).

TAIL UNIT.—Cantilever monoplane type. Two-spar all-metal tailplane and fin. Alclad covered rudder and elevator with trim-tabs. Areas: fin 200 sq. ft. (18.58 m.²), rudder 34.6 sq. ft. (3.21 m.²), elevators 46.8 sq. ft. (4.35 m.²) tailplane 169.5 sq. ft. (15.75 m.²). Tailplane span 26 ft. 2 in. (7.98 m.).

LANDING GEAR.—Retractable tricycle type. Dowty oleo shock-absorbers. Hydraulic retraction. All units fitted with twin wheels. Nose-wheel steerable and fully-castoring. Goodyear or Dunlop tubeless tyres and disc brakes. Wheelbase (Mark I) 12 ft. 9 in. (3.9 m.), (Mark II) 18 ft. 2 in. (5.54 m.). Wheel track 21 ft. 8 in. (6.60 m.).

POWER PLANT.—Two Rolls-Royce Dart R.Da.6 Mk. 512 turboprop engines, each with 1,730 e.s.h.p. available for take-off and provision for water-methanol system. Rotol four-blade feathering and braking airscrews 10 ft. (3.05 m.) in diameter. One integral fuel tank of 565 Imp. gallons (2,568.5 litres) capacity and one outer wing bag tank of 75 Imp. gallons (340.9 litres) capacity in each wing. Max. total internal fuel capacity 1,280 Imp. gallons (5,818.8 litres), all outboard of engines.

ACCOMMODATION.—Flight compartment for two pilots, with separate station for radio-operator/navigator. Radio and radar operated by second pilot by remote control when navigator is not carried. Main cabin floor, flat and level throughout, is 32 ft. 6 in. (9.91 m.) long with volume of 1,275 cub. ft. (36.1 m.³) on Mark I aircraft, and 42 ft. 6 in. (12.95 m.) long with volume of 1,695 cub. ft. (48.0 m.³) on Mark II aircraft. Maximum internal width is 8 ft. (2.44 m.). Passenger accommodation of the Mark I can range from 6 executive seats with tables, divans, etc. up to 28 normal type seats. The Mark II can accommodate up to 40 seats. Provision for luggage and personal baggage both forward and aft. Seats may be folded to cabin sides to accommodate freight forward, with a movable flexible bulkhead to separate freight and passengers when both are carried. A large freight door is provided to permit easy loading of large and bulky items.

DIMENSIONS.—
Span 82 ft. 6 in. (25.16 m.).
Length (Mark I) 62 ft. 1 in. (18.92 m.).
Length (Mark II) 72 ft. 1 in. (21.97 m.).

WEIGHTS AND LOADINGS.—
Payload and fuel (Mark I) 12,400 lb. (5,625 kg.).
Initial take-off weight 28,500 lb. (12,928 kg.).

PERFORMANCE (I.S.A. conditions at 28,500 lb.=12,928 kg. A.U.W. estimated).—
Mean cruising speed at 15,000 ft. (4,575 m.) 292 m.p.h. (471 km.h.).
Mean cruising speed at 25,000 ft. (7,625 m.) 295 m.p.h. (475 km.h.).
Stalling speed (flaps down) at 26,000 lb. (11,793 kg.) A.U.W. 74 m.p.h. (119 km.h.).
Rate of climb at S/L. 1,500 ft./min. (460 m./min.).
Rate of climb at S/L. one engine out, 500 ft./min. (153 m./min.).
Time to 25,000 ft. (7,625 m.) 27.6 min.
Take-off to 50 ft. (15.25 m.) at S/L. 2,740 ft. (835 m.).
Take-off to 50 ft. (15.25 m.) at 5,000 ft. (1,525 m.) 3,100 ft. (945 m.).
One engine cut BCAR field length at S/L. 3,220 ft. (980 m.).
One engine cut BCAR field length at 5,000 ft. (1,525 m.) 4,000 ft. (1,220 m.).
Max. stage, internal fuel, IFR, 2,073 miles (3,336 km.).
Max. stage, internal fuel, VFR, 2,400 miles (3,863 km.).
Time for above stages, IFR 7.6 hours, VFR 8.7 hours.

AVRO

A. V. ROE & CO., LTD.

HEAD OFFICE: GREENGATE, MIDDLETON, MANCHESTER.

LONDON OFFICE: 18, ST. JAMES'S SQUARE, W.1.

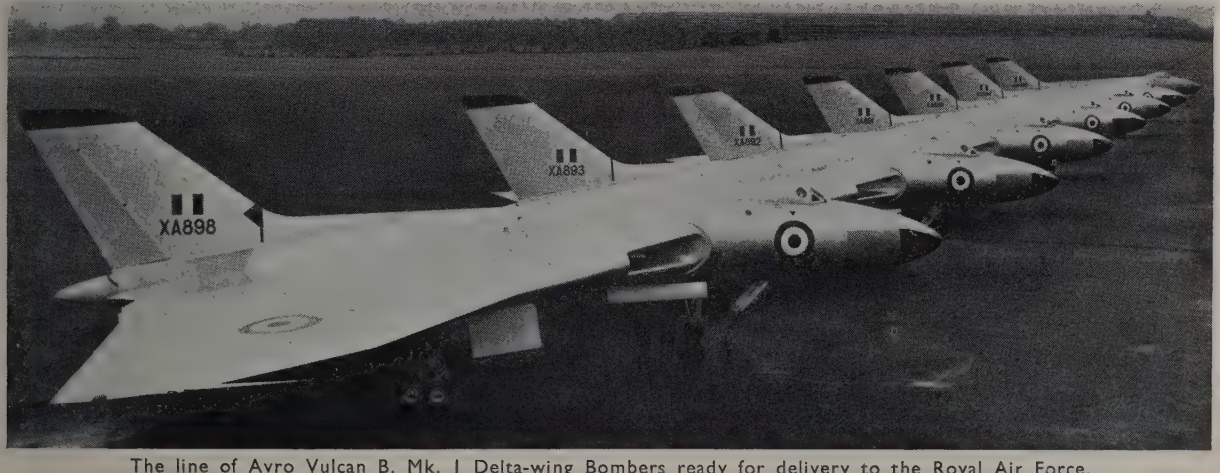
Directors: Sir Frank Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman); Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; Sir Roy H. Dobson, C.B.E., F.R.Ae.S. (Managing Director); Sir William Farren, C.B., M.B.E., M.A., F.R.S., M.I.Mech.E., F.R.Ae.S. (Technical Director); C. E. Fielding, O.B.E., F.R.Ae.S., M.I.P.E. (Production); S. G. Joy (Secretary and Director); J. A. R. Kay, A.F.R.Ae.S. (General Manager); and J. Green, O.B.E. (Controller-General, Engineering).

Chief Designer: J. R. Ewans, A.C.G.I., B.Sc., D.I.C., A.F.R.Ae.S.

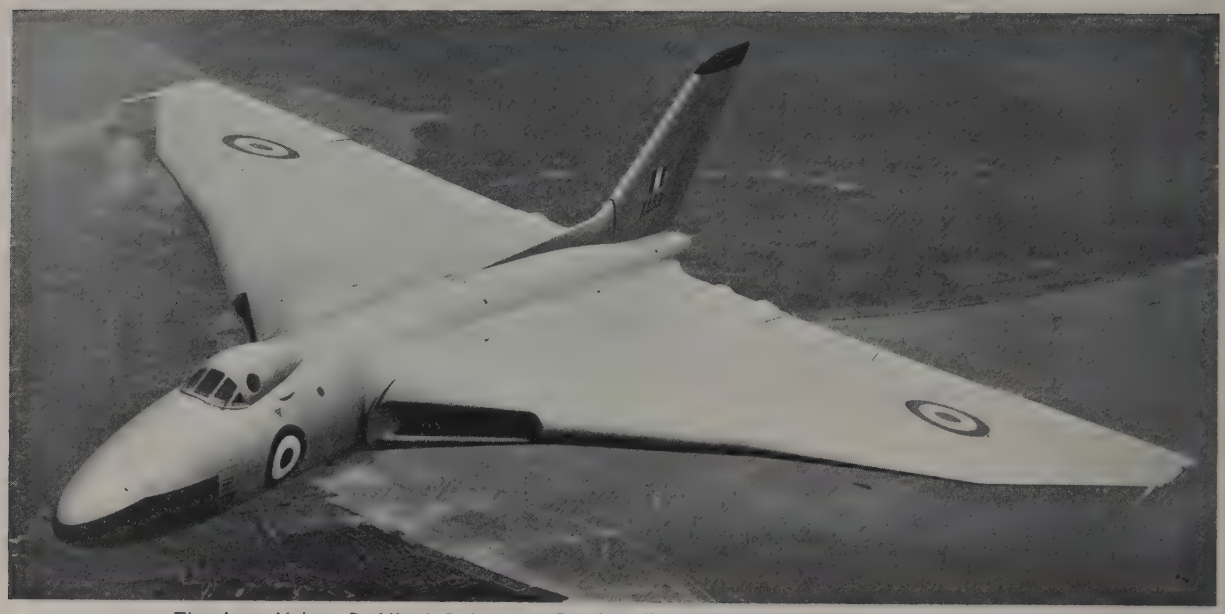
A. V. Roe & Co. was formed in 1910, when the firm advertised itself as constructors of aeroplanes and accessories, and was probably the first firm in Great Britain to do so. The limited company was formed in January, 1913. On the amalgamation of the Hawker and Siddeley interests in 1935, the Avro Company, which formerly was a member of the Siddeley group, became a member of the group of companies controlled by the Hawker Siddeley Group.

In 1947 the Avro company embarked on an extensive progamme of delta-wing research, following its decision to meet an official specification for a long-range medium bomber with an aircraft of that configuration. A series of small jet-powered delta-wing aircraft, roughly one-third the size of the proposed Type 698 bomber, were built for low-speed research (Types 707 and 707B), high-speed research (Type 707A) and flight familiarisation (Type 707C). The first 707 made its first flight on September 4, 1949, followed by the 707B on September 6, 1950, two 707A's in June, 1951, and February, 1953, respectively, and the two-seat 707C on July 1, 1953.

Of the four Type 707 research aircraft, one of them is still flying in Australia



The line of Avro Vulcan B. Mk. 1 Delta-wing Bombers ready for delivery to the Royal Air Force.



The Avro Vulcan B. Mk. I Delta-wing Bomber (four Bristol Olympus 100 Series engines).

under the ægis of the Department of Supply, to which it has been loaned by the British Ministry of Supply, for boundary layer control experiments.

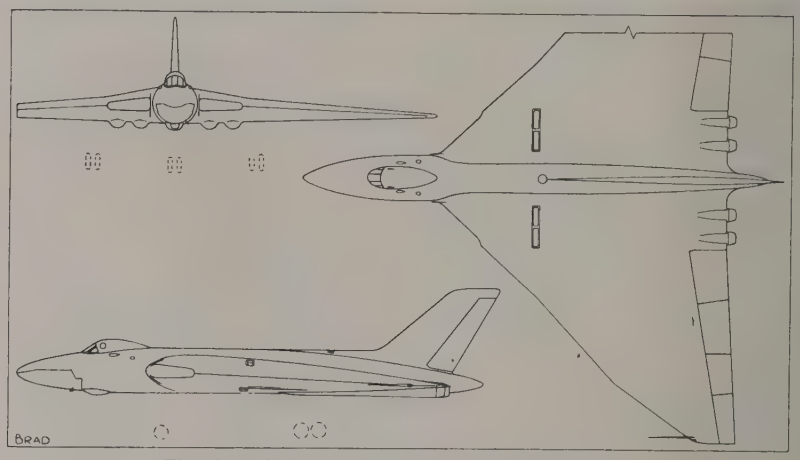
The Type 698 Vulcan is in production for the Royal Air Force and went into service with No. 83 Squadron in 1957. Also in production is the Shackleton four-engined maritime reconnaissance aircraft. The Shackleton is in operational service with R.A.F. Coastal Command and is also being supplied to the South African Air Force.

Avro are also engaged on the development of guided weapons, including a powered "stand-off" bomb that will be carried by the R.A.F.'s Vulcan and Victor bombers. To facilitate this work, the company has a weapons Research Establishment at Salisbury, South Australia, near the Woomera rocket range.

THE AVRO TYPE 698 VULCAN.

The Vulcan, the first jet bomber to employ the delta wing configuration, is the result of extensive research work with the Avro 707A and 707B.

The first prototype Vulcan (VX770) powered by four Rolls-Royce Avon turbojet engines, flew for the first time on August 30, 1952, but this aircraft was later fitted with four Armstrong Siddeley Sapphire engines. A second prototype (VX777) powered by four Bristol Olympus turbojet engines made its initial flight on September 3, 1953. This second prototype was later provided with wings having a re-designed leading-edge with compound sweepback, and in this form it made its first flight on October 5, 1955.



The Avro Vulcan B. Mk. I Delta-wing Bomber.

All production Mk. 1 Vulcans are fitted with wings having the new leading-edge configuration. Two versions of the Vulcan have been announced :—

Vulcan B. Mk. 1. First production version with four Bristol Olympus 100 Series turbojets. First B. Mk. 1 (XA 889) flew on February 4, 1955. Crew of five.

Vulcan B. Mk. 2. Developed version to have 16,000 lb. (7,257 kg.) s.t. Bristol Olympus 200 Series turbojets and wing of increased span. Aerodynamic prototype of the Mk. 2 (modified second Vulcan prototype VX777) flew for the first time on August 31, 1957.

In addition, the original prototype Vulcan (VX770) has been fitted experimentally with four Rolls-Royce Conway turbojets, making its first flight in this form on August 9, 1957.



The Avro Shackleton M.R. Mk. 3 Maritime Reconnaissance Monoplane (four 2,450 h.p. Rolls-Royce Griffon 67 engines).



An Avro Shackleton M.R. Mk. 3 equipped with an A/S.R. lifeboat.

DIMENSIONS (B. Mk. 1). —
Span 99 ft. (30.15 m.).
Length 97 ft. 1 in. (29.61 m.).
Height 26 ft. 6 in. (8.08 m.).

THE AVRO TYPE 696 SHACKLETON.

The Shackleton is in service in R.A.F. Coastal Command.

Shackleton M.R. Mk. 1 and 1A. First production versions. Prototype Mk. 1 first flew on March 9, 1949. 77 built.

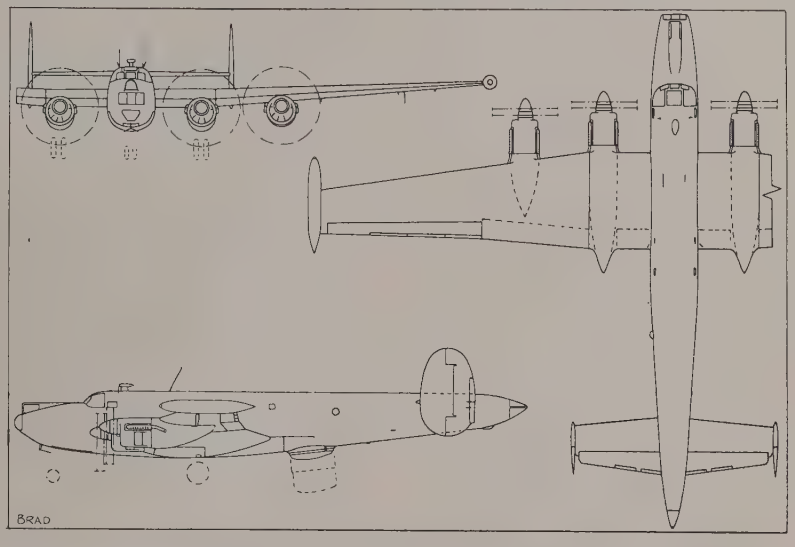
Shackleton M.R. Mk. 2. More powerfully armed and cleaner version of Mk. 1. New nose with two additional 20 mm. cannon aimed by gunner who sits above bomb-aimer. Fixed under-nose radome of Mk. 1 deleted and replaced in Mk. 2 by retractable radome located under fuselage aft of bomb-bay. Rear fuselage faired off with transparent terminal cone to provide look-out position. Single fixed tail-wheel of Mk. 1 replaced by twin retractable wheels. The Mk. 2 prototype flew for the first time on June 17, 1952. At least one fitted with MAD submarine detection gear in tail "sting" fairing. Dimensions : Span same as for Mk. 1. Length 87 ft. 4 in. (26.6 m.). Height 16 ft. 9 in. (5.1 m.).

Shackleton M.R. Mk. 3. Developed version of Mk. 2. Nose-wheel landing-gear ; increased fuel capacity, incorporating wing-tip tanks ; new clear-view cockpit canopy ; internal changes for increased crew comfort, etc. In production for Royal Air Force and South African Air Force. First production Mk. 3 (WR970) flew on September 2, 1955.

Shackleton T. Mk. 4. Mk. 1 converted for use by the Maritime Reconnaissance School as a navigation trainer.

TYPE.—Four-engined Long-range Maritime Reconnaissance monoplane.

WINGS.—Cantilever mid-wing monoplane. Wing root aerofoil NACA 23018. Incidence 4°. Dihedral on outer planes (true) 4°. Two-spar all-metal structure. Hydraulically-operated split trailing-edge flaps, two between fuselage and inner nacelles, and two outboard of inner nacelles. Total flap area 187.3 sq. ft. (17.40 m.²). Ailerons in outer wing panels, with trim and balance tabs in each. Total aileron area 113.4. sq. ft. (10.55 m.²). Gross wing area 1,421



The Avro Shackleton M.R. Mk. 3.



The Avro Shackleton M.R. Mk. 3 Maritime Reconnaissance Monoplane (four 2,450 h.p. Rolls-Royce Griffon 67 engines).

sq. ft. (132.4 m.²). T.K.S. porous-metal leading-edge de-icing.

FUSELAGE.—Light-alloy stressed skin semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane tail and end-plate fins and rudders. All-metal structure. Total tailplane area 285.4 sq. ft. (26.6 m.²). Elevator area (including tabs) 87.30 sq. ft. (8.13 m.²). Trim-tab area (two) 3.56 sq. ft. (0.331 m.²). Balance tab area (two) 3.54 sq. ft. (0.329 m.²). Total vertical tail area 223 sq. ft. (20.75 m.²). Total rudder area (including combined balance/trim tabs) 100.2 sq. ft. (9.5 m.²). T.K.S. porous-metal leading-edge de-icing

LANDING GEAR.—Retractable tail-wheel (Mks. 1, 2 and 4 or nose-wheel (Mk. 3) type. Main wheels each carried between two oleo-pneumatic shock-absorbing legs, retract backward hydraulically into inner engine nacelles. Single fixed (Mk. 1) or dual retractable (Mk. 2) tail-wheel unit.

POWER PLANT.—Four 2,450 h.p. Rolls-Royce Griffon 67 twelve-cylinder Vee liquid-cooled engines, each driving a de Havilland six-blade co-axial counter-rotating constant-speed fully-feathering airscrew, diameter 13 ft. (3.96 m.).

ACCOMMODATION.—Crew of ten. Pilot's compartment in forward fuselage section, seating two side-by-side. Other crew positions in nose and fuselage.

ARMAMENT.—Two 20 mm. cannon in Bristol B.17 dorsal turret. Large single bomb compartment can accommodate variety of anti-shipping weapons in many combinations. Equipment includes extensive radio and radar, provision for carrying A/S.R. lifeboat, etc.

DIMENSIONS.—
Span (Mk. 1 and 2) 120 ft. 0 in. (36.6 m.).
Span (Mk. 3) 120 ft. 6½ in. (36.75 m.).
Length (Mk 1.) 77 ft. 6 in. (23.6 m.).
Length (Mk. 2 and 3) 87 ft. 4 in. (26.6 m.).
Height (Mk. 1) 17 ft. 6 in. (5.3 m.).
Height (Mk. 2) 16 ft. 9 in. (5.1 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

BLACKBURN

BLACKBURN AND GENERAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: BROUGH, EAST YORKS.

LONDON OFFICE: 43, BERKELEY SQUARE, W.1.

Directors: E. Turner A.C.A. (Chairman and Managing Director), Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S., N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., F.R.Ae.S., Whit.Ex., Sir Maurice Bonham Carter, K.C.B., K.C.V.O., Marshal of the Royal Air Force Sir John Slessor, G.C.B., D.S.O., M.C., Air Vice-Marshal H. N. Thornton, C.B.E., T. Bancroft and A. F. Jopling, A.C.A.

Secretary: R. H. Stone, A.C.A.

Chief Designer: B. P. Laight, A.F.R.Ae.S.

The Blackburn Aeroplane Company was founded by the late Mr. Robert Blackburn, who designed, built and flew his first aeroplane in 1909, and the company has continued to manufacture aircraft ever since.

In 1930 the Cirrus Hermes Engineering concern was taken over and Blackburns thus added aero-engines to their range of products.

In 1936 the Blackburn Aeroplane and Motor Co., Ltd. was turned into a public company under the name Blackburn Aircraft Ltd. and in January, 1949, Blackburn Aircraft Ltd. and General Aircraft Ltd. of Feltham, Middlesex, merged to form Blackburn and General Aircraft Ltd.

Since this merger, Blackburn and General Aircraft has developed the Beverley four-engined freighter, which is in service in the Royal Air Force.

Projected civil and military developments of the Beverley, on which the company is known to be working, will have Rolls-Royce Tyne turboprop engines, a re-designed pressurised fuselage and a retractable landing-gear, giving a considerably improved performance, with a maximum speed of approximately 360 m.p.h. (580 km.h.).

Blackburn and General Aircraft is also building a new supersonic strike aircraft known as the NA.39 for the Royal Navy, but no details of this may yet be published.

Details of the Cirrus Engine Division of Blackburn and General Aircraft, Ltd. will be found in the "Gas Turbine" and "Piston Engine" sections of this volume.

THE BLACKBURN NA.39.

It was announced early in 1957 that Blackburn is developing a supersonic strike aircraft for the Royal Navy to replace the Westland Wyvern. Designated NA.39, it has been described as being "really a bomber" and "ahead of anything in its class in the world." No details have been released for publication.

THE BLACKBURN BEVERLEY.

The Beverley C. Mk. 1 is the production version of the Universal four-engined transport which was basically a General Aircraft design. The first prototype, powered by four 2,020 h.p. Bristol Hercules 730 engines, was in an unfinished state when Blackburn and General Aircraft merged in 1949 and the aircraft was transferred to and completed at Brough. It flew for the first time on June 20, 1950. A second prototype with four 2,850 h.p. Bristol Centaurus engines and other modifications flew in June, 1953, and this aircraft served as the prototype for the Beverley.

The first production Beverley C. Mk. 1 made its maiden flight on January 29, 1955, and the type now equips several squadrons of R.A.F. Transport Command.

Assisted take-off experiments in 1956 showed that the use of ten Scarab rockets, mounted five on each side of the rear fuselage, enables a fully-loaded Beverley C. Mk. 1 to take off within 400 yards (365 m.). From two to ten rockets can be used, as necessary.

TYPE.—Heavy Freight and/or Troop Transport and Tactical Support aircraft for the dropping of heavy stores and parachute troops.

WINGS.—High-wing cantilever monoplane. Modified R.A.F. 34 wing section. Aspect ratio 9. Dihedral 0°54′ inner wings, 3° 54′ outer wings. Chord 25 ft. 8 in. (7.84 m.) at root (on centre-line), 10 ft. 6 in. (3.2 m.) at tip. All-metal light alloy structure. Wing in four main sections, two inner and two outer, plus detachable tips, with no centre section. Main spar at 25% chord and rear spar at 55% chord. Warren-girder type ribs, widely spaced. Longitudinal stringers reinforce skin except over two outer fuel cells, where chord-wise beams are used. Thermal leading-edge de-icing. NACA slotted trailing-edge flaps over inner wing sections. Electric infinitely-variable flap operation. Modified Frise type ailerons, with trim and balance tabs on both sides. Push-pull torque control system, combining aileron and trim controls in single run. Fairey hydraulic power-control units. Flap area (each) 189 sq. ft. (17.5 m.²). Aileron area (aft of hinge) (each) 84 sq. ft. (7.8 m.²). Tab area (aft of hinge) (each) 5.5 sq. ft. (0.51 m.²). Gross wing area 2,916 sq. ft. (270 m.²).

FUSELAGE.—All-metal light-alloy structure in four sections; nose compartment, main freight compartment, crew compartment, and tail boom compartment. Main freight and nose compartments have built-up frames, heavily re-inforced floor and closely-spaced lengthwise stringers to stiffen the skin. Skin and stringer construction of crew compartment with light channel-section frames, and tail boom roof and rear fuselage similar with addition of extruded section stringers. Rear end of main freight compartment closed by pair of clamshell doors.

TAIL UNIT.—Cantilever monoplane tailplane with outrigged fins and rudders. De-icing

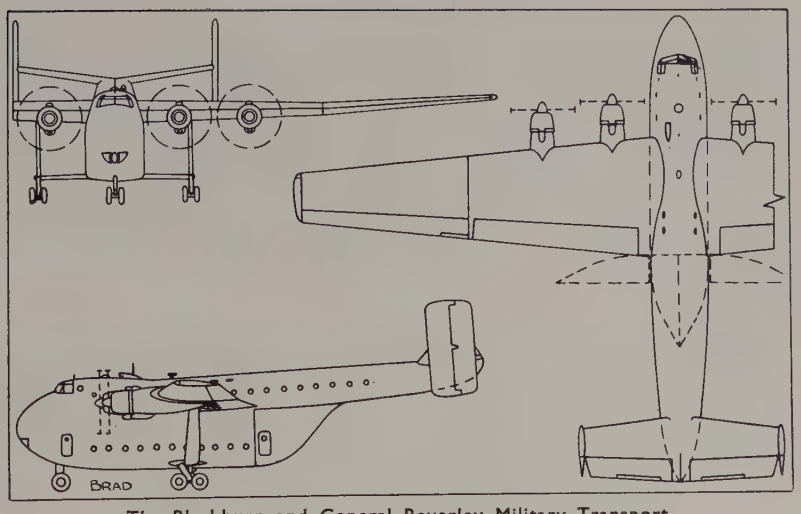


The Blackburn and General Beverley Military Transport (four 2,850 h.p. Bristol Centaurus 173 engines).

equipment in leading-edges. Dihedral on tailplane 7° 34′. Two-spar tailplane with pressed sheet ribs. Fin construction similar. Elevators and rudders are single-spar structures with pressed sheet ribs, all metal-covered. Trim-tabs in all surfaces. Control systems for rudders and elevators operate the elevator and rudder tabs respectively. Gross tailplane and elevator area 526 sq. ft. (48.9 m.²). Total elevator area (aft of hinge) 145.15 sq. ft. (13.45 m.²). Trim-tab area each 7.41 sq. ft. (0.687 m.²). Gross fin and rudder area 391.2 sq. ft. (36.3 m.²). Total rudder area (aft of hinge) 62.4 sq. ft. (5.79 m.²). Trim-tab area each 6.26 sq. ft. (0.585 m.²). Tailplane span 43 ft. 2 in. (15.10 m.).

Landing Gear.—Fixed nose-wheel type with four-wheel bogie main units. Main Lockheed shock-absorber units attached to wings at upper ends and supported by horizontal sponsons from bottom corners of fuselage frames. Two built-up spars converging at shock-absorber leg in each light-alloy covered sponson. Twin Dunlop nose wheels sprung by Lockheed shock-absorber leg. Nose-wheel unit can be power-steered through an angular movement of ± 45°. Main wheels mounted on beam which is pivoted on main shock-absorber and sprung by Lockheed damper strut. Normal wheels have tyres with pressure of 80 lb./sq. in. Alternative wheels for operation from soft strips may be substituted. These have a pressure of 48 lb./sq. in., the tyres being identical to those used on the nose wheel. Hydraulic differential braking on main wheels, which incorporate the Maxaret non-skid system. Wheelbase (between C/L of struts) 28 ft. 8 in. (8.74 in.). Track (between C/L of struts) 33 ft. 5in. (10.18 m.).

Power Plant.—Four Bristol Centaurus 173 eighteen-cylinder radial air-cooled engines with single-speed superchargers, each developing 2,850 h.p. for take-off at 2,800 r.p.m. with water/methanol injection. Rated powers; normal climb and continuous rich mixture cruising, 2,390 h.p. at 4,500 ft. (1,370 m.); lean mixture continuous cruising 1,720 h.p. at 11,500 ft. (3,500 m.). Access to equipment in engine nacelles (not to power-units) in flight or for ground maintenance through rear auxiliary bulkhead from internal wing crawlway. D.H. four-blade hollow steel reversible-pitch braking airscrews 16 ft. 6 in. (5.03 m.) diameter, with electric de-icing. Up to ten Scarab solid-propellent rockets may be mounted on rear fuselage to assist take-off when necessary. Fuel is carried in eight flexible tanks, four in each wing. Capacities are: No. 1 tanks 1,040 Imp. gallons (4,720 litres) each, No. 2 tanks 1,140 Imp. gallons (5,180 litres) each, No. 3 tanks 660 Imp. gallons (2,970 litres) each, No. 4 tanks 600 Imp. gallons (2,720 litres) each.



The Blackburn and General Beverley Military Transport.

Total fuel capacity 6,880 Imp. gallons (31,300 litres). No. 2 tanks are bullet-proof and Nos. 1 and 2 tanks have fire-extinguishers. Pressure fuelling and defuelling is provided for all tanks from points on the fuselage sides at the sponson leading-edge.

Accommodation.—Flight deck laid out for crew of four, two pilots, radio operator and navigator. Sighting position for supply dropping in extreme nose and despatchers' positions are provided adjacent to parachute exits. Main freight compartment is 40 ft. long, 10 ft. high and 10 ft. wide (12.2 m. × 3.05 m. × 3.05 m.), and the tail compartment is 44 ft. long, 6 ft. high and 8 ft. 6 in. wide (13.4 m. × 1.83 m. × 2.59 m.). Floors of both compartments have flush lashing points/seat attachments on a 20-inch grid and lashing rings and rails are provided on walls of the main freight compartment. Floor of main freight compartment stressed for a loading of 325 lb./sq. ft., with reinforcement for wheeled vehicles with an axle load of up to 12,500 lb. (5,675 kg.). The following are the standard complements:—Troops 94 (58 in freight and 36 in tail compartments), Paratroops 70 (40 in freight and 30 in tail compartments), Ambulance 82 (48 stretcher cases in freight and 34 sitting cases in tail compartments). Heavy drop platform retaining and release gear is provided for individual loads of up to 25,000 lb. (11,350 kg.) and divided loads of up to full military load. The rear fairing doors are removed for dropping operations. Hinged loading ramps at rear of freight floor may be removed when not required.

Dimensions.—
Span 162 ft. (49.5 m.).
Length 99 ft. 5 in. (30.3 m.).
Height overall 38 ft. 5 in. (11.7 m.).

Weights and Loadings.—
Basic weight (normal equipment) 82,100 lb. (37,273 kg.).
Payload, fuel and oil 52,900 lb. (24,020 kg.).
Gross weight 135,000 lb. (61,200 kg.).
Wing loading 46.4 lb./sq. ft. (226.5 kg./m.²).
Power loading 11.84 lb./h.p. (5.37 kg./h.p.).

Performance.—
Max. speed 238 m.p.h. (384 km.h.) at 5,700 ft. (1,740 m.).
Max. continuous cruising speed 223 m.p.h. (359 km.h.) at 5,000 ft. (1,525 m.).
Max. lean mixture cruising speed 194 m.p.h. (312 km.h.) at 12,500 ft. (3,800 m.).
Recommended cruising speed 175 m.p.h. (282 km.h.) at 8,000 ft. (2,440 m.).
Take-off distance to 50 ft. (15.25 m.) 1,340 ft. (408 m.).
Landing distance from 50 ft. (15.25 m.) 910 ft. (277 m.).
Range with 1,000 lb. (454 kg.) payload at 188 m.p.h. (302 km.h.) at 8,000 ft. (2,440 m.) 3,690 miles (5,938 km.).
Range with 44,000 lb. (19,958 kg.) payload at 145 m.p.h. (233 km.h.) at 8,000 ft. (2,440 m.) 200 miles (322 km.).

BOULTON PAUL

BOULTON PAUL AIRCRAFT, LTD.

Head Office, Works and Aerodrome: Wolverhampton.

London Office: Kinnaird House, 1, Pall Mall East, S.W.1.

Incorporated: June, 1934.

Chairman and Managing Director: J. D. North, F.R.Ae.S., M.I.Mech.E., F.S.S.

Directors: J. Kissane, C.A., R. Beasley, G. C. Haynes, A.C.A. (Secretary) and F. F. Crocombe, B.Sc., A.C.G.I., D.I.C., F.R.Ae.S. (Chief Engineer).

Boulton Paul Aircraft Ltd. was formed in 1934 to take over the old-established Aircraft Department of Boulton & Paul Ltd. of Norwich which began the manufacture of aircraft in 1915.

In addition to the design and construction of aircraft, Boulton Paul has designed and produced an extensive range of electro-hydraulically operated gun-turrets. More recently, the company has specialised in the development of electronic aids to research, testing and design. It has also developed high-fidelity power control systems for aircraft and units of this type are incorporated in the Vickers Valiant and Avro Vulcan bombers, and other types.

The first aircraft produced by the company after the War was the Balliol two-seat trainer with a Rolls-Royce Merlin engine, which went into service with the Royal Air Force, the Royal Navy and the Ceylon Air Force. More recently Boulton Paul designed and built the P.111 delta-wing high-speed research monoplane. Both these aircraft have been illustrated and described in previous editions of "All the World's Aircraft."

BRISTOL

THE BRISTOL AEROPLANE CO., LTD.

Head Office: Filton, Bristol.

London Office: 6, Arlington Street, St. James's, S.W.1.

Directors: Sir Reginald Verdon Smith, M.A., B.C.L., J.P. (Chairman and Joint Managing); Sir G. Stanley White (Deputy Chairman); G. S. M. White (Joint Managing); Capt. K. J. G. Bartlett, C.B.E., A.F.R.Ae.S.; C. F. Uwins, O.B.E., A.F.C.; Brian Davidson; A. E. Russell, C.B.E., D.Sc., F.R.Ae.S.; Air Chief Marshal Sir W. Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C.; William Masterton, C.A.; Dr. S. G. Hooker, O.B.E., D.Ph., D.I.C., F.R.Ae.S.; Air Cdre. F. R. Banks, C.B., O.B.E.

Secretary: J. F. Harper, C.A.

The Bristol Aeroplane Co., Ltd., is the holding company for the following British and overseas subsidiary companies:—Bristol Aircraft, Ltd.; Bristol Aero-Engines, Ltd.; Bristol Cars, Ltd.; The Bristol Aeroplane Company of Canada (1956), Ltd., Montreal; Bristol Aero Engines, Ltd., Montreal; Bristol Aero Engines (Western), Ltd., Vancouver; Bristol Aircraft (Western), Ltd., Winnipeg; The Bristol Aeroplane Company (Australia), Pty., Ltd., Melbourne; Bristol Aviation Services, Pty., Ltd., Sydney; Bristol Aeroplane Company (New Zealand), Ltd., Wellington; Bristol de Mexico Sa. de CV., Mexico City; The Bristol Aeroplane Company (U.S.A.) Inc., New York.

Details of the products of Bristol Aircraft, Ltd., follow hereunder. Products of Bristol Aero-Engines, Ltd, are fully described in the Engine Section.



The Bristol Britannia 102 Airliner (four 3,900 e.h.p. Bristol Proteus 705 turboprop engines).

BRISTOL AIRCRAFT, LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, BRISTOL.

OTHER WORKS: WESTON-SUPER-MARE AND CARDIFF.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, S.W.1.

Directors: C. F. Uwins, O.B.E., A.F.C., F.R.Ae.S. (Chairman); P. G. Masefield, M.A.(Eng.), C.I.Mech.E., F.R.Ae.S., F.I.Ae.S., M.Inst.T. (Managing); Sir Reginald Verdon Smith, M.A., B.C.L., J.P.; Brian Davidson; Air Cdre. F. R. Banks, C.B., O.B.E.; A. E. Russell, C.B.E., DSc., F.R.Ae.S., F.I.Ae.S. (Chief Engineer); R. S. Brown (Works Director); W. R. Farnes O.B.E. (Sales); T. B. Pritchard (Financial) and G. E. Knight (Commercial).

Secretary: A. D. Cawse.

General Manager, Weston division: W. Strachan.

Chief Designer (Fixed-wing Aircraft): W. J. Strang, B.Sc., Ph.D., A.F.R.Ae.S.

Chief Designer (Rotary-wing Aircraft): R. Hafner, F.R.Ae.S.

Chief Designer (Guided Missiles): D. J. Farrar, M.A., A.F.R.Ae.S.

Bristol Aircraft, Ltd. is a subsidiary of the Bristol Aeroplane Company, Ltd., which was founded in 1910 and was known originally as The British and Colonial Aeroplane Company, Ltd.

Now in production are the Bristol Type 175 Britannia medium/long-range airliner, on order for B.O.A.C. and other operators, the Type 171 helicopter, and the twin-engined/twin-rotored Type 192 helicopter which is a development of the Type 173 research aircraft.

In order to meet production requirements, a second production line for the Britannia has been set up at Belfast by Short Brothers & Harland, Ltd.

Canadair, Ltd. of Montreal, P.Q. is building a long-range maritime reconnaissance version of the Britannia, known as the CL-28 Argus, for the Royal Canadian Air Force and a military transport version of this type under the designation CL-44. Details of these aircraft will be found under "Canadair."

Bristol Aircraft are also engaged on the development of guided weapons and it was announced early in 1957 that their Bloodhound surface-to-air missile would be the first weapon of this type to enter service with the Royal Air Force in 1958. Details of the Bloodhound, and of the Bobbin test vehicles which preceded it, will be found in the "Guided Missiles" section of this work.

Another important activity of Bristol Aircraft is the production of plastic drop fuel tanks, which are standard on many British military aircraft types.

Early in 1957, the company's factories at Oldmixon, where all helicopter work is concentrated, and at Banwell, where rocket-motor tubes and high-pressure gas storage vessels are manufactured, were incorporated in a newly-formed Weston division, under their own general manager.

THE BRISTOL TYPE 175 BRITANNIA.

A fleet of 33 Britannias is being built for B.O.A.C. and the first of these aircraft entered scheduled service on February 1, 1957. The Britannia is a considerable advance on the Medium-Range Empire transport proposed by B.O.A.C. in 1947. All the aircraft at present under construction have four Bristol Proteus turboprop engines. A later stage in Britannia development will be the installation of the Bristol Orion constant-power turboprop engine which is being developed under a Ministry of Supply contract, and this engine is also specified for the CL-44, a version of the Britannia being built by Canadair.

The five main versions of the Britannia are distinguished by the Series numbers 100, 250, 300, 310 and 400.

The **100 Series** is powered by four 3,900 e.h.p. Proteus 705 engines and has a basic interior layout for from 60 first-class to 92 tourist class passengers. It includes the following versions:—

Britannia 101. Prototype of 100 Series. Two built, the first (G-ALBO) flying for the first time on August 16, 1952. Second prototype (G-ALRX) flew on December 23, 1953, but was lost through a forced landing in the Severn estuary on February 4, 1954. First prototype now being used by Bristol Aero-Engines, Ltd. for power-



The Bristol Britannia 102 Airliner (four 3,900 e.h.p. Bristol Proteus 705 turboprop engines).

plant development; in 1956 was flown first with two Proteus 705 engines in inner nacelles and two Proteus 755 engines in outer nacelles and later with an Orion turboprop engine replacing the port outer Proteus.

Britannia 102. First production version. Fifteen for B.O.A.C. The first (G-ANBA) flew on September 15, 1954, and the first two were delivered to B.O.A.C. on December 30, 1955.

The **250 Series** is a mixed cargo/passenger version. It is similar to the 310 Series (see below) with lengthened fuselage and 4,120 e.h.p. Proteus 755 engines. Forward freight compartment has strengthened floor. The following versions have been ordered :—

Britannia 252. Three long-range trooping aircraft for the Ministry of Supply. Being built by Short Bros. & Harland, Ltd., Belfast.

Britannia 253. Thirteen long-range aircraft for R.A.F. Transport Command. Being built by Short Bros. & Harland, Ltd., Belfast.

The **300 Series** is a development of the 100 Series with the 10 ft. 3 in. (3.12 m.) longer fuselage and Proteus 755 engines. Accommodation for up to 133 tourist class passengers. This series includes the :—

Britannia 301. Prototype (G-ANCA) of 300 Series. First flew on July 31, 1956. Eventually to be fitted with four Orion turboprops for flight testing.

Britannia 302. First production version of 300 Series. Two for Aeronaves de Mexico. Being built by Short Bros & Harland, Ltd., Belfast.

Britannia 305. Five for Northeast Airlines. Similar to 302 but with strengthened wings and Series 310 wing fuel tankage for long-range operation. Being built by Short Bros. & Harland, Ltd., Belfast.

The **310 Series** is a long-range version of the 300 with additional wing tankage. This Series includes :—

Britannia 311. Prototype (G-AOVA) of 310 Series. First flew on December 31, 1956. Later converted to 312 standard for delivery to B.O.A.C. (see below).

Britannia 312. Eighteen for B.O.A.C.

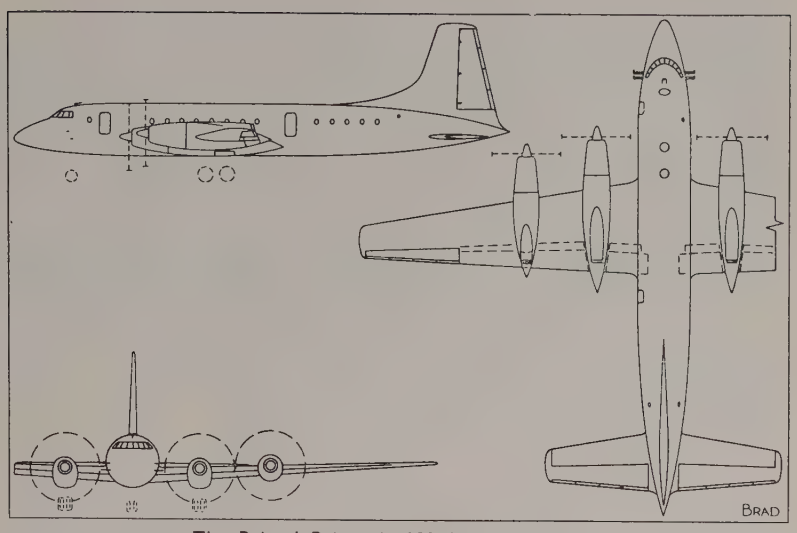
Britannia 313. Three for El Al, Israel Airlines, with option for two more.

Britannia 314. Six for Canadian Pacific Airlines, with option for further five. Being built by Short Bros. & Harland, Ltd., Belfast.

Britannia 317. Two for Hunting-Clan Airlines, Ltd., with option for one more.

Britannia 318. Two for Compania Cubana de Aviacion.

The high-density medium range versions of the 310 Series with accommodation for up to 133 passengers are economically competitive over stage lengths from 200 to 2,600 miles (320-4,200 km.) when operated at a reduced all-up weight, and have a guaranteed cruising speed of 400 m.p.h. (645 km.h.). These versions can be fitted with integral passenger steps.



The Bristol Britannia 100 Series Airliner.

The **400 Series** will be similar to the long-range 310, but powered by four Bristol Orion turboprop engines.

The description which follows covers all the basic types referred to above, with the exception of the Series 400, of which no details are yet available.

TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 25017 at root, tapering to NACA 4413 modified at tip. Aspect ratio 9.76. Dihedral constant from roots, 3°. Incidence 3° at root, 0.6° at tip. Root chord 22 ft. 7¼ in. (6.88 m.). Aluminium-alloy box-spar stressed skin structure. Servo-tab-operated ailerons in outer wings and double-slotted trailing-edge flaps each side on inner wing. Thermal anti-icing. Total area of ailerons 70 sq. ft. (6.52 m.²). Total area of flaps 401 sq. ft. (37.25 m.²). Gross wing area 2,075 sq. ft. (192.7 m.²).

FUSELAGE.—Aluminium-alloy monocoque structure pressurised to 8.25 lb./sq. in. Maximum diameter 12 ft. (3.66 m.).

TAIL UNIT.—Cantilever metal tailplane and single fin and rudder. Aluminium-alloy box-spar structure. Servo tabs in all control surfaces. Areas: fin 264.2 sq. ft. (24.5 m.²), rudder 92.2 sq. ft. (8.56 m.²), tailplane 418 sq. ft. (38.8 m.²), elevators 170 sq. ft. (15.6 m.²). Tailplane span 55 ft. (16.7 m.).

LANDING GEAR.—British Messier retractable nose-wheel type. Main units beneath inner nacelles each have a four-wheel bogie. Nose unit has twin wheels. Hydraulic retraction. Dunlop wheels and Dunlop Maxaret hydraulic brakes. Wheel track (bogie centres) 31 ft. 0 in. (9.45 m.). Wheelbase 35 ft. 3.4 in. (10.80 m.).

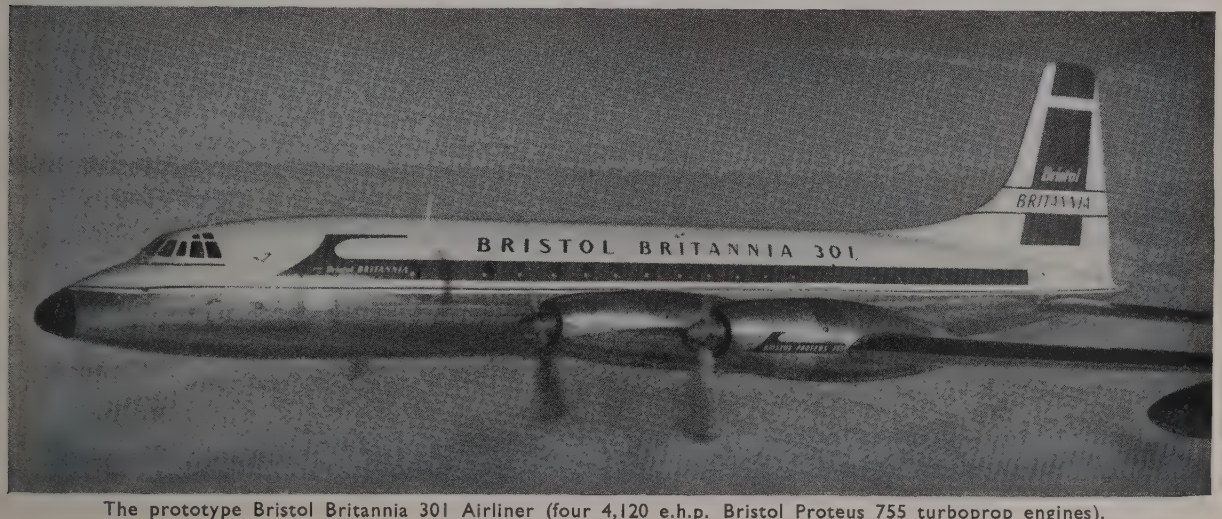
POWER PLANT.—Four 3,900 e.h.p. Bristol Proteus 705 (100 Series) or 4,120 e.h.p. Proteus 755 (250, 300 and 310 Series) turboprop engines driving de Havilland hydromatic four-blade airscrews. Main fuel tankage in wing-spar box. Total internal fuel capacity (100 and 300 Series) 6,670 Imp. gallons (30,327 litres). Total internal fuel capacity (250 and 310 Series) 8,486 Imp. gallons (38,576 litres). Total oil capacity (all versions) 36 Imp. gallons (164 litres).

ACCOMMODATION (100 Series).—Crew of 8 and up to 92 passengers in pressurized cabin. Main passenger accommodation in two cabins, in centre fuselage and rear fuselage, with main entrance (port side) between. Additional entrance and pantry forward. Basic 92-seat tourist layout capable of conversion without structural alteration to alternative arrangements providing reduced seating capacity at first class standards. Baggage compartment immediately aft of flight deck. Freight holds below cabin floor.

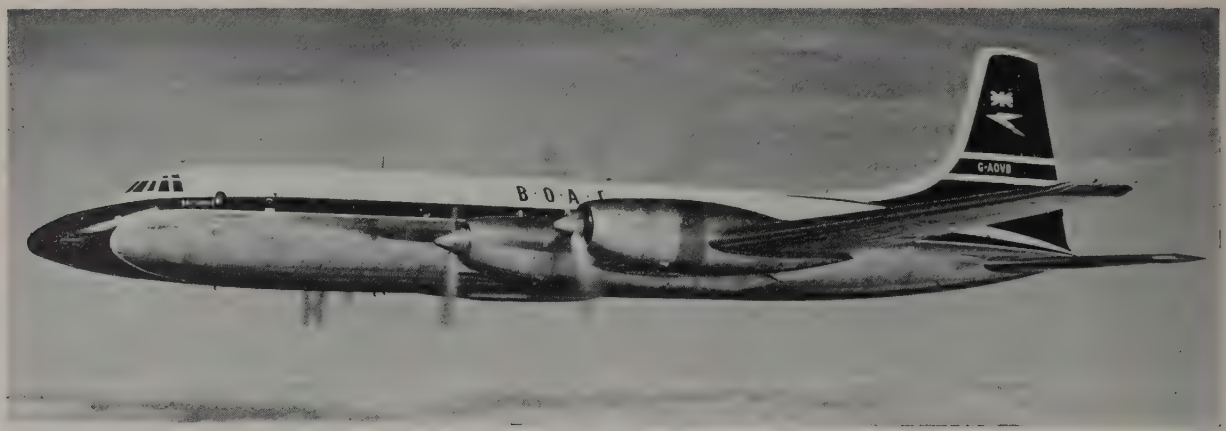
ACCOMMODATION (250 Series).—Crew of 7 and 84 passengers (basic tourist layout). Freight compartment capacity 824 cub. ft. (23.33 m.³) on main deck, in addition to freight holds below cabin floor. Capable of conversion without structural alteration to alternative layout providing 13 additional seats instead of cargo and two additional seats in lieu of pantry equipment.

ACCOMMODATION (300 Series).—Crew of 9 and up to 133 passengers (basic tourist layout), capable of conversion without structural alterations to alternative layouts providing reduced seating capacity at first-class standards.

ACCOMMODATION (310 Series).—Crew of 9 and up to 133 passengers (basic tourist day



The prototype Bristol Britannia 301 Airliner (four 4,120 e.h.p. Bristol Proteus 755 turboprop engines).



The Bristol Britannia 312 Airliner (four 4,120 e.h.p. Bristol Proteus 755 turboprop engines).

layout), capable of conversion without structural alteration to mixed first-class/tourist day seating or wholly or partially to first-class seating or sleeping berth accommodation. Alternative seating arrangements are for 73 or 93 passengers, with an eight-seat "club" lounge in the rear fuselage.

DIMENSIONS (100 Series).—
Span 142 ft. 3½ in. (43.38 m.).
Length 114 ft. (34.77 m.).
Height 36 ft. 8.3 in. (11.19 m.).

DIMENSIONS (250,300 and 310 Series).—
Span 142 ft. 3½ in. (43.38 m.).
Length 124 ft. 3 in. (37.89 m.).
Height 37 ft. 6 in. (11.43 m.).

WEIGHTS (100 Series).—
Weight empty 85,175 lb. (38,640 kg.).
Max. payload 25,000 lb. (11,340 kg.).
Max. all-up weight 155,000 lb. (70,370 kg.).
Max. landing weight 125,000 lb. (56,700 kg.).

WEIGHTS (250 Series).—
Weight empty 89,157 lb. (40,440 kg.).
Max. payload 31,000 lb. (14,062 kg.).
Max. all-up weight 175,000 lb. (79,380 kg.).
Max. landing weight 133,000 lb. (60,329 kg.).

WEIGHTS (300 Series).—
Weight empty 86,900 lb. (39,417 kg.).
Max. payload 30,000 lb. (13,608 kg.).
Max. all-up weight 160,000 lb. (72,608 kg.).
Max. landing weight 130,000 lb. (59,000 kg.).

WEIGHTS (310 Series).—
Weight empty 87,695 lb. (39,779 kg.).
Max. payload 30,000 lb. (13,608 kg.).
Max. all-up weight 175,000 lb. (79,380 kg.).
Landing weight 133,000 lb. (60,329 kg.).

PERFORMANCE (100 Series).—
Normal high-speed cruise at 140,000 lb. (63,400 kg.) A.U.W. 361 m.p.h. (580 km.h.).
Long-range cruising speed at 140,000 lb. (63,400 kg.) A.U.W. 328 m.p.h. (527 km.h.)
Still-air range with max. payload (25,000 lb. = 11,340 kg.) 3,200 miles (5,150 km.) at 361 m.p.h. (580 km.h.).
Still-air range with 15,741 lb. (7,140 kg.) payload and full tanks 4,250 miles (6,830 km.) at 361 m.p.h. (580 km.h.).
Take-off distance to 50 ft. (15.25 m.) at S/L, I.S.A., at max. A.U.W. 5,360 ft. (1,632 m.).
Landing distance from 50 ft. (15.25 m.) at S/L, I.S.A., at max. landing weight 3,120 ft. (950 m.).

PERFORMANCE (300 Series).—
Normal high-speed cruise at 140,000 lb. (63,400 kg.) A.U.W. 390 m.p.h. (626 km.h.).
Long-range cruising speed at 140,000 lb. (63,400 kg.) A.U.W. 346 m.p.h. (556 km.h.)
Still-air range with max. payload (30,000 lb. = 13,608 kg.) 3,020 miles (4,850 km.) at 390 m.p.h. (626 km.h.).
Still-air range with 19,016 lb. (8,610 kg.) payload and full tanks 3,860 miles (6,200 km.) at 390 m.p.h. (626 km.h.).
Take-off distance to 50 ft. (15.25 m.) at S/L, I.S.A., at max. A.U.W. 5,200 ft. (1,585 m.).
Landing distance from 50 ft. (15.25 m.) at S/L, I.S.A., at max. landing weight 3,350 ft. (1,020 m.).

PERFORMANCE (310 Series).—
Cruising speed as for 300 Series.
Still-air range with 30,000 lb. (13,608 kg.) payload 3,960 miles (6,360 km.) at 390 m.p.h. (626 km.h.).
Still-air range with 18,585 lb. (8,410 kg.) payload and full tanks 4,810 miles (7,740 km.) at 390 m.p.h. (626 km.h.).
Take-off distance to 50 ft. (15.25 m.) at S/L, I.S.A., at max. A.U.W. 6,200 ft. (1,890 m.).
Landing distance from 50 ft. (15.25 m.) at S/L, I.S.A., at max. landing weight 3,410 ft. (1,040 m.).

THE BRISTOL TYPE 173.

The Bristol Type 173 was the company's second helicopter design and the first British multi-engined helicopter. It uses two similar rotors, one at each end of the fuselage and each driven by its own engine. The rotors and rotor heads are, in fact, essentially similar to those of the Type 171.

The first prototype flew for the first time on January 3, 1952, and in 1953 successfully made a series of trials at sea on board H.M. aircraft-carrier *Eagle*.

A second prototype was for a time fitted experimentally with auxiliary wings to explore their effect on forward flight performance.

Both the first and second prototype 173's are powered by two 500-520 h.p. Alvis Leonides engines. One of them was delivered to B.E.A. in July, 1956 for handling trials, and so became the first twin-engined helicopter in the World to be accepted by an airline.

The third, fourth and fifth prototypes have two Alvis Leonides Major engines of 850 h.p. each, and have been built for research and development flying to obtain data required for the design of later Bristol twin-rotor helicopters. They have a strengthened fuselage to meet the increase in loaded weight and a higher rear rotor pylon than the earlier prototypes.

The description which follows refers to the third prototype, which flew for the first time on November 9, 1956.

TYPE.—Research and Development Helicopter.

ROTOR SYSTEM.—Two four-blade rotors, one on top of forward fuselage, other carried on rear pylon. Rotor blades in prototypes are of wooden construction; production aircraft will have metal rotors. Basic blade section NACA 006-0015. Total disc area 3,720 sq. ft. (34.75 m.²).

ROTOR DRIVE.—Each rotor driven by shaft from engine immediately beneath. Rotors are linked by a synchronisation shaft to ensure running at same speed and in correct



The first prototype Bristol 173 Research Helicopter in its current configuration (two 520 h.p. Alvis Leonides 73 engines).

phase, and to permit one engine to drive both rotors in case of one engine failing. A free wheel and clutch in the drive shaft between each engine and its rotor makes it possible to isolate a dead engine, and provides for full autorotation.

Fuselage.—Metal monocoque structure. Front section contains flight deck and is largely panelled with Perspex; next is front engine bay, including fuel and oil and drive to front rotor; then main passenger cabin; and finally, the rear engine bay, together with rear fuel tank, rear rotor pylon and tailplane, with end-plate fins.

Landing Gear.—Four-wheel fixed type. Track 8 ft. 6 in. (2.59 m.). Wheelbase 28 ft. 8 in (8.76 m.).

Power Plant.—Two 850 h.p. Alvis Leonides Major fourteen-cylinder radial air-cooled engines mounted with crankshafts vertical. Each engine in steel cowling forming a fire-proof box and separate from cabin and pilot's cockpit by soundproof bulkheads.

Accommodation.—Crew of two in forward compartment. Provision for dual control. Crew access doors on each side of nose. Main passenger cabin between two engine bays, 28 ft. 9 in. (8.77 m.) long, 5 ft. 3 in. (1.60 m.) wide and 5 ft. 3 in. (1.60 m.) high plus 5½ in. (14 cm.) for aisle recess. Five individual seats down each side of central sunken aisle, with curved settee for three at rear on starboard sides, opposite main access door in port side. Six windows each side are jettisonable for emergency exit. Cabin provides 700 cub. ft. (19.83 m.³) of constant section stowage.

Controls.—Collective pitch on both rotors operated conjointly by single collective pitch lever in cockpit. Fore and aft control is obtained through control column, by altering differentially the collective pitch of rotors in conjunction with simultaneous cyclic pitch changes. Lateral control is by simultaneous change of cyclic pitch and tilting rotor discs laterally. Directional control is by rudder pedals, which produce differential cyclic pitch change and tilt the rotors laterally in opposite directions.

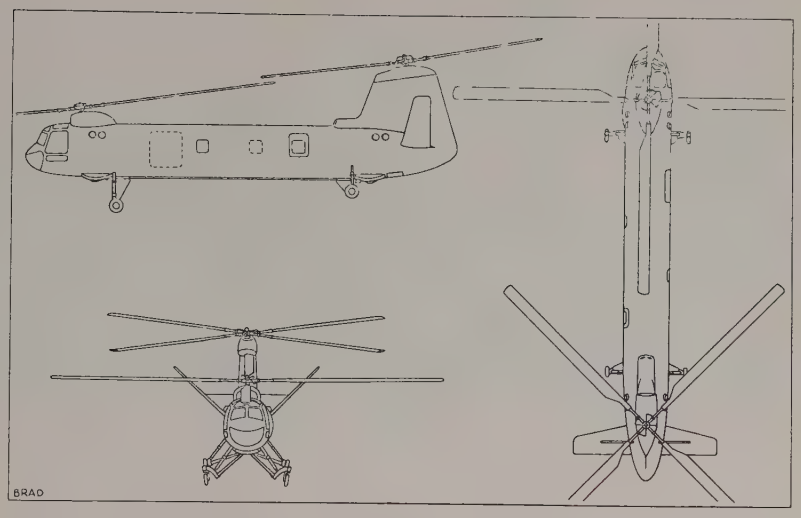
Dimensions.—
- Rotor diameter, each 48 ft. 6.7 in. (14.80 m.).
- Rotor centres 41 ft. 1¼ in. (12.53 m.).
- Overall length (rotors folded) 54 ft. 1¾ in. (16.51 m.).
- Overall width (rotors folded) 18 ft. 0 in. (6.48 m.).
- Overall height (rotors folded) 16 ft. 6¼ in. (5.03 m.).
- Height to front hub centre 9 ft. 9¼ in. (2.97 m.).
- Height to rear hub centre 16 ft. 6¼ in. (5.03 m.).

Weights and Loadings.—
- Weight empty 9,839 lb. (4,465 kg.).
- Crew (two) 340 lb. (154 kg.).
- Fuel and payload 2,572 lb. (1,168 kg.).
- Oil 144 lb. (65 kg.).
- Max. all-up weight 13,500 lb. (6,125 kg.).
- Disc loading 3.63 lb./sq. ft. (17.65 kg./m.²).
- Power loading 7.9 lb./h.p. (3.58 kg./h.p.).

Performance.—
- No data available.

THE BRISTOL TYPE 191.

Quantity production of this twin-rotor helicopter for service with the Royal Navy was originally contemplated; but following a re-assessment of naval aircraft requirements, arising from changed strategic circumstances, it was decided to limit production to a small number of prototypes required for essential development work in connection with the Type 192.



The Bristol 192 Series 2 Helicopter.

THE BRISTOL TYPE 192.

The Type 192 twin-rotor helicopter, is a development of the Type 173 which has been ordered for service with the Royal Air Force; and a civil variant known as the Type 192C will also be used experimentally by B.E.A. It has been designed to meet requirements for a large helicopter capable of troop and freight transport, paratrooping, supply dropping, ambulance duties and search-and-rescue operations. It is fully-equipped for day and night instrument flying, with provision for an automatic pilot and dual controls. The crew stations are heated.

The Type 192 Series 2, now in production, has two Napier Gazelle Series 2 gas-turbine engines, each developing 1,050 h.p. continuous power, with a one-hour rating of 1,300 h.p. and emergency rating of 1,650 h.p. Fuel capacity is 560 Imp. gallons (2,545 litres).

Accommodation.—Crew of two, with 12 stretcher cases in tiers of three, three sitting wounded and a medical orderly in ambulance rôle; an aircrewman and ten or more persons in search and rescue rôle; maximum distributed load of 6,000 lb. (2,721 kg.) for freight duties; or 18-25 fully-armed troops according to range. Cabin is 24 ft. 1 in. long, 5 ft. 3 in. wide and 4 ft. 11 in. high (7.34 × 1.60 × 1.50 m.). Loading winch can lift loads up to 600 lb. (270 kg.). Loads up to 5,250 lb. (2,380 kg.) can be carried externally under fuselage, with mechanical or electrical quick-release gear.

Dimensions.—
- Diameter of rotors each 48 ft. 8 in. (14.83 m.).
- Length overall 89 ft. 9¼ in. (27.35 m.).
- Distance between rotor centres 41 ft. 1¼ in. (12.53 m.).
- Height 17 ft. (5.18 m.).

Weight and Loadings.—
- Max. loaded weight 18,000 lb. (8,165 kg.).
- Disc loading 8.83 lb./sq. ft. (43.11 kg./m.²).
- Power loading 9.8 lb./h.p. (4.44 kg./h.p.).

Performance.—
- Cruising speed 138 m.p.h. (222 km.h.).
- Vertical rate of climb on two engines, each giving 920 h.p. 500 ft./min. (150 m./min.).
- Max. rate of climb with forward speed 1,175 ft./min. (358 m./min.).
- Rate of climb on one engine, giving 1,300 h.p. 160 ft./min. (50 m./min.).
- Rate of climb on one engine at emergency power 760 ft./min. (230 m./min.).
- Service ceiling 13,250 ft. (4,040 m.).
- Hovering ceiling without ground effect 8,000 ft. (2,440 m.).
- Range with 18 troops 288 miles (463 km.).
- Ferrying range with extra tanks 715 miles (1,149 km.).

THE BRISTOL TYPE 171 SYCAMORE.

The Type 171, which first flew in 1947, was the first rotating wing aircraft to be built by the Bristol company. In service as a civil transport and in a number of military and naval rôles, the Type 171 provides accommodation for five persons, including one or two pilots. The standard power-unit is the Alvis Leonides Mk. 73.

Some 150 of these helicopters were scheduled for completion by the end of 1957.

The current versions are:—

Type 171 Mk. 4. Current production version for casualty evacuation and search and rescue, but capable of conversion for passenger and freight transport. The change-over from one version to another can be made rapidly.

The following military versions have also been produced:—

Sycamore H.C. Mk. 10. Primarily an ambulance with accommodation for two standard stretchers carried athwartships at back of cabin, one above the other. Ends of stretchers accommodated by Perspex blisters, one on each side of cabin. Swivel seat for medical attendant.

Sycamore H.C. Mk. 11. Communications, observation and transport version in service with British Army. Standard R.A.F. and Army radio. Rope ladder for use over unsuitable landing terrain. Strong points under fuselage for carrying loads up to 1,600 lb. (726 kg.).

Sycamore H.R. Mk. 12. Search and rescue or communications aircraft in service with R.A.F. Coastal Command.



The Bristol Sycamore H.R. Mk. 14 Helicopter (520 h.p. Alvis Leonides engine).



Two Bristol Sycamore Helicopters in the colours of armed forces of the Federal German Republic.

Sycamore H.R. Mk. 13. Search and rescue or communications aircraft in service with R.A.F. Fighter Command.

Sycamore H.R. Mk. 14. Search and rescue, ambulance or communications aircraft for service with the R.A.F. A variant of the Mk. 14 is in large-scale production for service with the Federal German Forces.

Sycamore H.R. Mk. 50 and 51. Search and rescue or communications aircraft in service with the Royal Australian Navy. Similar to Mks. 13 and 14 respectively. Hydraulically operated winch on starboard side of fuselage. Seats of folding "deck chair" type, to give increased working space for winch operation and rescue work. Open starboard doorway covered by quick-release curtain for rescue missions. In communications rôle winch is removed and starboard door aperture covered by metal panel containing a knock-out Perspex escape hatch. Side exhaust to avoid burning or scorching when landing in scrub or on ship's deck. Modified instrument panel layout.

The description below refers primarily to the Mk. 4 version which is now in production.

TYPE.—Four or Five-seat Civil or Military Helicopter.

ROTOR SYSTEM.—Three-blade main rotor and three-blade anti-torque rotor. Blades, of Bristol design, of wooden construction with Hydulignum spar along leading-edge, spruce and ply ribs and plywood covering. Two sheet metal tabs, one in vicinity of blade tip and the other near root, correct aerodynamic balance. Blades fully articulated in both flapping and drag planes. Adjustable friction dampers on drag hinges, and spacer rods with rubber buffers between blades. All-metal blades are now being developed.

ROTOR DRIVE.—Drive from engine taken through centrifugal clutch via a vertical shaft to main gear-box below rotor head, which has a two-stage spur reduction gear. From this main gear-box a further drive is taken to shaft which runs down rear fuselage through constant-velocity Hardy Spicer universal joint to a bevel gear-box and so to tail rotor. Free wheel ensures both main and tail rotors will auto-rotate in event of engine failure. Rotor brake above free wheel. Accessories driven from main rotor gear-box, so that they continue to function in event of engine failure.

FUSELAGE.—In three sections, nose, centre and rear. Nose section is metal monocoque with Perspex and metal fairing. Centre-section has welded steel-tube frames with metal skin. Rear section is a metal monocoque.

LANDING GEAR.—Fixed tricycle type with castoring nose-wheel. Pneumatic shock-absorbers to all three wheels. Tail skid aft to prevent damage to tail rotor. Wheel track 9 ft. (2.74 m.).

POWER PLANT.—One 500/520 h.p. Alvis Leonides Mk. 73 nine-cylinder radial air-cooled engine mounted with crankshaft vertical in fuselage centre-section. Engine-driven cooling fan draws air through intake above cabin. Air is ducted from fan past fully-cowled and baffled engine and exhausted through grille at bottom of fuselage centre-section. Steel cowling above cylinders and steel bulkheads below, enclose engine in fireproof box. Graviner spray-ring fire-extinguisher system controllable by pilot. Bag-type fuel cell behind rear engine bulkhead in intermediate fuselage. Normal fuel capacity 65 Imp. gallons (295 litres); with auxiliary tank, 89 Imp. gallons (404 litres). Oil tank above engine on rear engine bulkhead in fuselage centre-section. Total oil capacity 6.5 Imp. gallons (29.5 litres).

ACCOMMODATION.— *Search and Rescue*: crew of two with three rear "deck-chair" type seats for rescued personnel. *Ambulance*: pilot and medical orderly and accommodation for two stretcher cases. *Passenger transport, communications, etc.*: four or five persons including crew.

CONTROLS.—Main flying controls consist of a collective-pitch lever, control stick and foot pedals. In addition to the primary controls, a bias gear, operated by hand-wheels, relieves the load on the control stick, and assists in the longitudinal and lateral trim. A mechanical linkage is provided between the throttle and the collective pitch lever so that the throttle opening is automatically synchronised with increase or decrease of main rotor blade pitch. Over-ride settings of the throttle can be obtained by means of a twist-grip on the pitch lever. The engine clutch is automatic in operation. Full dual control may be provided, but is not normally fitted.

DIMENSIONS.—
- Main rotor diameter 48 ft. 6.7 in. (14.8 m.).
- Tail rotor diameter 9 ft. 7.3 in. (2.93 m.).
- Length (rotors at extreme positions) 61 ft. 1¼ in. (18.63 m.).
- Length (main rotor folded, tail rotor at min. position) 46 ft. 2 in. (14.1 m.).
- Height (tail rotor in extreme position) 14 ft. 7 in. (4.49 m.).
- Height (tail rotor in min. position) 12 ft 2 in. (3.71 m.).

WEIGHTS.—
- Basic weight (general purpose) 4,060 lb. (1,853 kg.).
- Basic weight (ambulance rôle) 4,138 lb. (1,881 kg.).
- Basic weight (search and rescue rôle) 4,150 lb. (1,887 kg.).
- Weight loaded (Mk. 4) 5,600 lb. (2,540 kg.).
- Weight loaded (Mk. 14) 5,400 lb. (2,452 kg.).

PERFORMANCE (at 5,400 lb. = 2,452 kg. A.U.W. —I.C.A.N. conditions).—
- Max. speed (5 min. rating) (sea level), 127 m.p.h. (204 km.h.) at 287 rotor r.p.m.
- Max. speed (1 hr. rating) (at 2,000 ft. = 610 m.) 121 m.p.h. (195 km.h.) at 269 rotor r.p.m.
- Max. rich mixture cruising speed (at 2,000 ft. = 610 m.) 107 m.p.h. (172 km.h.) at 251 rotor r.p.m.
- Max. economical cruising speed (at 2,000 ft. = 610 m.) 91 m.p.h. (146 km.h.) at 242 rotor r.p.m.
- Max. vertical rate of climb (sea level) 420 ft./min. (128 m./min.).
- Max. climb at forward speed (5 min. power, sea level), 1,300 ft./min. at 60 m.p.h. I.A.S. (396 m./min. at 96 km.h.).
- Service ceiling 15,500 ft. (4,724 m.).
- Hovering ceiling (without ground effect) 4,000 ft. (1,220 m.).
- Max. still air range at normal load, 268 miles (430 km.).
- Max. still air range with auxiliary tank (total fuel 89 Imp. gal. = 404 litres) 368 miles (589 km.).

DE HAVILLAND

DE HAVILLAND HOLDINGS, LTD.

HEADQUARTERS: GREAT NAST HYDE, HATFIELD, HERTFORDSHIRE.

Directors: W. E. Nixon, F.C.I.S. (Chairman and Managing Director); Sir Geoffrey de Havilland, C.B.E., A.F.C., R.D.I., F.R.Ae.S., Hon.F.I.Ae.S.; F. E. N. St. Barbe; A. F. Burke, O.B.E., M.Inst.T., F.R.S.A.; A. S. Kennedy, C.A.; and Sir Ralph S. Sorley, K.C.B., O.B.E., D.S.C., D.F.C., F.R.Ae.S.

Special Directors: H. Buckingham; P. C. Garratt.

In 1955, The de Havilland Aircraft Co., Ltd., the parent company of the de Havilland Enterprise, was renamed de Havilland Holdings, Ltd. At the same time, its aircraft manufacturing and trading activities were transferred to a wholly-owned subsidiary which then assumed the name of The de Havilland Aircraft Co., Ltd.

The three main operating subsidiaries in the United Kingdom are now:—

The de Havilland Aircraft Co., Ltd., Hatfield, Herts.

The de Havilland Engine Co., Ltd., Leavesden, Watford, Herts.

de Havilland Propellers Ltd., Hatfield Aerodrome, Herts.

Each of these companies is represented on the Board of de Havilland Holdings, Ltd., the latter being responsible for finance and for co-ordination of policy.

Associated Companies overseas are:—

The de Havilland Aircraft Pty., Ltd., Box 30, P.O. Bankstown, N.S.W., Australia.

The de Havilland Aircraft Company of New Zealand, Ltd., Rongotai, Wellington, New Zealand.

The de Havilland Aircraft of Canada, Ltd., Postal Station L, Toronto, Canada.

The de Havilland Aircraft Company of South Africa (Pty.) Ltd., P.O. Box 7105, Johannesburg, South Africa.

The de Havilland Aircraft Company (Rhodesia) Ltd., P.O. Box 329, Salisbury, S. Rhodesia.

de Havilland Aircraft Inc., Marine Terminal, La Guardia Airport, Flushing, New York, U.S.A.

It was announced on November 5, 1956, that de Havilland Holdings, Ltd. had acquired an interest in Saunders-Roe, Ltd., of East Cowes, Isle of Wight.



The D.H. Sea Vampire T. Mk. 20 Trainer (D.H. Goblin turbojet engine). (*J. D. Rawlings*).

THE DE HAVILLAND AIRCRAFT CO., LTD.

Administration, Design, Experimental and Engineering Departments, Technical School, Etc.: Hatfield Aerodrome, Herts.

Production Factories: Hawarden Aerodrome, near Chester, Hatfield, Herts., Christchurch, Hants., Portsmouth, Hants., and Stevenage, Herts.

President: Sir Geoffrey de Havilland, C.B.E., A.F.C., R.D.I., F.R.Ae.S., Hon. F.I.Ae.S.

Chairman: W. E. Nixon, F.C.I.S.

Managing Director: A. F. Burke, O.B.E., M.Inst.T., F.R.S.A.

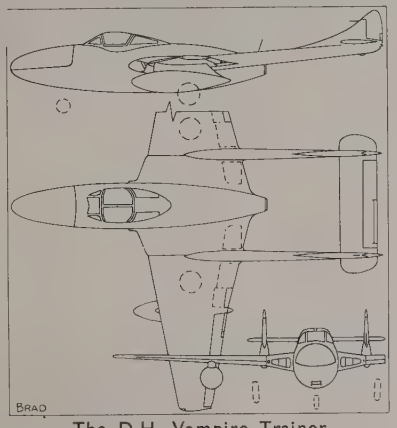
Other Directors: F. E. N. St. Barbe, R. E. Bishop, C.B.E., F.R.Ae.S., H. Povey, Hon. F.R.Ae.S., C. S. Thom, R. M. Clarkson, O.B.E., B.Sc., A.C.G.I., F.R.Ae.S. and A. S. Kennedy, C.A.

Secretary: W. D. Rennie.

The de Havilland Aircraft Company Limited was founded at Stag Lane, Edgware, in September, 1920, although the origins of the company go back to 1908 when Geoffrey de Havilland designed and built his first aeroplane. Divisions of the company for production of Gipsy engines and variable-pitch airscrews were formed in 1928 and 1935, and overseas companies were formed in 1927 (Australia) 1928 (Canada), 1929 (India), 1930 (South Africa) and 1939 (New Zealand).

Post-war civil production began with the Dove light transport, nearly 500 of which have been built. This was followed in 1950 by the four-engined Heron feeder-liner which is in production and in service in twenty countries.

The company's most important undertaking in the civil field has, however, been with the Comet jet airliner. In the early months of 1954, after some 30,000 hours of test and airline flying, two accidents to B.O.A.C. Comet I's resulted in the grounding of all Comets. At the subsequent official enquiry the cause of the accidents was found to be a hitherto unsuspected manifestation of metal fatigue in the skin of the pressure cabin.



The D.H. Vampire Trainer.

After improvements in accordance with the knowledge gained from an extensive research and investigation programme by de Havilland and the R.A.E., the Comet 2 is now in service with R.A.F. Transport Command. Flight testing and development of the Comet 3 prototype is continuing, and B.O.A.C. has ordered a fleet of 19 production Comet 4's for delivery in 1958-59. Six Comet 4B's have been ordered by B.E.A.

Developed during the war, but too late to see operational service, the Vampire single-seat jet fighter became the most widely-adopted fighter in the world, being supplied to the Air Forces of seventeen countries.

Later development of the basic Vampire led to the T. Mk. 11 side-by-side all-purpose jet trainer and the Venom day, night and naval fighter.

The latest de Havilland fighter now in production for the Royal Navy is the Sea Vixen, a two-seat day and night all-weather fighter powered by two Rolls-Royce Avon engines.

Details of the products of the Australian and Canadian de Havilland companies may be found in the "Australia" and "Canada" sections respectively.

The products of the de Havilland Engine Co., Ltd. are to be found in the "Aero-Engines" section of this volume.

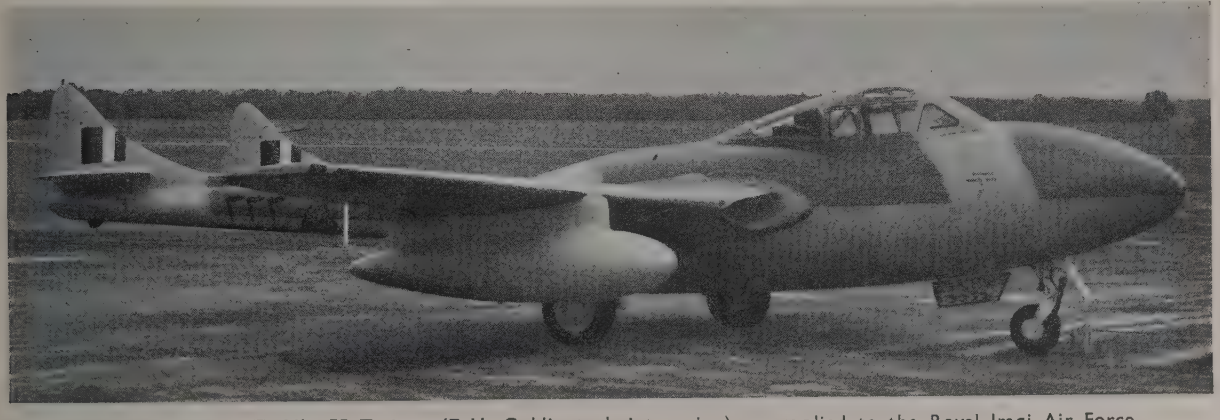
THE D.H. 115 VAMPIRE TRAINER.

Development of a trainer version of the Vampire jet fighter was undertaken by the de Havilland company as a private venture. Under the designations Vampire T. Mk. 11 and Sea Vampire T. Mk. 22, the trainer, one of the first to feature the principle of side-by-side seating for instructor and pupil, has been adopted as the standard advanced trainer of the Royal Air Force and the Royal Navy. It is also in service, as the Vampire T. Mk. 55, in the air forces of Australia, Burma, Chile, Egypt, Finland, India, Indonesia, Iraq, Lebanon, New Zealand, Portugal, South Africa, Rhodesia, Sweden, Switzerland, Venezuela, Ireland, Japan, Jordan and Syria.

The cabin is pressurized to a differential of 3 lb./sq. in., and is entered through a rearward-opening hood. All essential cockpit controls are duplicated.

The nose-cap hinges up to give access to certain equipment located in the forward fuselage, including a ciné-gun, radio, batteries and oxygen bottles. The normal Vampire armament of four 20 mm. cannon is retained in the fuselage belly. Rockets and bombs may also be carried.

Dimensions.—
Span 38 ft. 0 in. (11.59 m.).
Length 34 ft. 6½ in. (10.51 m.).
Wing area 261 sq. ft. (24.25 m.²).



The D.H. Vampire T. Mk. 55 Trainer (D.H. Goblin turbojet engine) as supplied to the Royal Iraqi Air Force.



The D.H. Heron Series 2 Light Transport (four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 engines).

WEIGHTS.—
Weight loaded (clean) 11,150 lb. (5,060 kg.).
Weight loaded (with two 100 Imp. gal. =455 litre drop tanks) 12,920 lb. (5,860 kg.).

PERFORMANCE (Clean).—
Max. speed at S/L. 538 m.p.h. (866 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 549 m.p.h. (885 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 521 m.p.h. (839 km.h.).
Initial rate of climb 4,500 ft./min. (22.8 m./sec.).
Climb to 20,000 ft. (6,100 m.) 5.6 min.
Climb to 40,000 ft. (12,200 m.) 16.3 min.
Still air range without external equipment 623 miles (955 km.) at 300 m.p.h. (480 km.h.) at 20,000 ft. (6,100 m.) and 853 miles (1,370 km.) at 403 m.p.h. (650 km.h.) at 40,000 ft. (12,200 m.).
Take-off distance to 50 ft. (15.25 m.) 910 yds. (832 m.).
Landing distance from 50 ft. (15.25 m.) 1,180 yds. (1,080 m.).
Limiting Mach No without external equipment at high altitudes 0.815.

THE D.H. 114 HERON.

The Heron is the latest addition to the long line of successful de Havilland light transports. Powered by four 250 h.p. ungeared and unsupercharged Gipsy Queen 30 Mk. 2 engines, providing a reserve of power unusual in an aircraft of this category, the Heron is now in service in twenty countries. The standard Heron airliner carries 14-17 passengers and the executive model has luxurious appointments for six-eight passengers.

The original Heron Series 1 with a fixed tricycle landing gear is no longer in production, having been superseded by the Heron Series 2 with a retractable tricycle landing gear.

Among the airlines and other operators which have taken delivery of Herons are New Zealand National Airways; Braathen's S.A.F.E. (Norway); Transportes Aereos Salvador (Brazil); Butler Air Transport (Australia); U.A.T. (France); Garuda Indonesian Airways; Jersey Airlines; PLUNA (Uruguay); Japan Air Lines; British European Airways; Turkish Airlines; Indian Airlines; West African Airways; Dragon Airways; Portuguese Ministry of Colonies; South African Air Force; Bahamas Airways; Cambrian Airways; AVIACO (Spain); Illini Airlines (U.S.A.); the West German Air Force and the Royal Iraq Air Force. In addition, a number of Herons are privately owned.

Three specially-equipped Heron Series 2 aircraft form the fixed-wing equipment of The Queen's Flight.

A full description of the Heron Series 1 has appeared in earlier editions of "All the World's Aircraft." The following data applies specifically to the Heron Series 2:—

TYPE.—Four-engined Feeder-line or Executive Transport.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 10.5. Light alloy structure with light alloy sheet skin. Goodyear pulsating-boot leading-edge de-icing. Ailerons in outer wing panels and trailing-edge flaps inboard in three pieces each side. Ailerons and flaps have metal frames and fabric covering. Flaps pneumatically-operated. Gross wing area 499 sq. ft. (46.4 m.^{2}).

FUSELAGE.—Light alloy monocoque structure. Wing centre-section spar integral with fuselage. Main cabin floor of sandwich construction, stressed for freight carrying.

TAIL UNIT.—Cantilever monoplane type. Metal frames with fixed surfaces metal-covered and movable surfaces fabric-covered. Tailplane span 21 ft. 0 in. (6.4 m.).

LANDING GEAR.—Retractable tricycle type. Pneumatically-operated. Each main leg has rubber shock absorbers. Nosewheel has an oleo-pneumatic shock-absorber and is castoring and self-centering. Pneumatic brake operation. Track 16 ft. 8 in. (5.1 m.).

POWER PLANT.—Four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 six-cylinder in-line air-cooled direct-drive unsupercharged engines. All engines on their bearers are interchangeable. D.H. 2/1000/2 bracket-type constant-speed two-blade airscrews, diameter 7 ft. (2.14 m.), feathering optional. Bag-type fuel tanks in each wing. Maximum fuel capacity 412 Imp. gallons (1,873 litres).

ACCOMMODATION.—Crew of two side-by-side in separate cockpit forward. Main passenger accommodation normally arranged for fourteen passengers in single seats each side of central aisle, with toilet at rear. Total cabin capacity 475 cub. ft. (13.45 m.^{3}).



The D.H. Heron Series 2 Light Transport (four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 engines).



The D.H. Sea Venom F. (A.W.) Mk. 21 Two-seat Naval All-weather Fighter (D.H. Ghost turbojet engine).

Luggage bay at rear, capacity 105 cub. ft. (2.97 m.³). Alternative accommodation for fifteen passengers, with smaller toilet compartment and rear luggage bay capacity 70 cub. ft. (1.98 m.³), or for 17 passengers with no toilet and rear luggage bay capacity 45 cub. ft. (1.27 m.³). In each arrangement there is a front luggage compartment, capacity 22 cub. ft. (0.623 m.³). Entrance at rear on port side. Headroom in cabin 5 ft. 8½ in. (1.77 m.).

EQUIPMENT.—Full radio, including Marconi AD97/108 transmitter-receiver, Marconi AD7092 or AD7092A Automatic Radio Compass, and Standard STR9X V.H.F. Provision for Marconi blind-approach equipment, standard STR12 V.H.F. or Murphy MR60B V.H.F. radio, and Sperry A.L.Ia. autopilot.

DIMENSIONS.—
Span 71 ft. 6 in. (21.8 m.).
Length 48 ft. 6 in. (14.8 m.).
Height 15 ft. 7 in. (4.75 m.).

WEIGHTS.—
Tare weight (incl. radio) 8,484 lb. (3,848 kg.).
Crew (2) 330 lb. (150 kg.).
Fuel (typical case) for 400 mile (644 km.) stage with I.F.R. allowances (184 Imp. gal.=836 litres) 1,325 lb. (601 kg.).
Oil (15.3 Imp. gal.=69.6 litres) 138 lb. (63 kg.).
Payload 3,223 lb. (1,462 kg.).
Weight loaded 13,500 lb. (6,124 kg.).

PERFORMANCE.—
Cruising speed at 8,000 ft. (2,440 m.) at 65% METO power 183 m.p.h. (295 km.h.).
Weak mixture cruise at 3,000 ft. (915 m.) 191 m.p.h. (307 km.h.).
Rate of climb at S/L. 1,075 ft./min. (5.47 m./sec.).
Rate of climb at S/L. on three engines 620 ft./min. (3.14 m./sec.).
T.O. distance to 50 ft. (15.2 m.), hard runway, airline method 2,425 ft. (740 m.).
T.O. distance to 50 ft. (15.2 m.) with one engine cut at safety speed 2,875 ft. (875 m.).
Landing distance from 50 ft. (15.2 m.) 2,065 ft. (630 m.).

THE D.H. 112 SEA VENOM.

The Sea Venom is a two-seat naval all-weather fighter which was evolved from the Venom N.F. 2 two-seat night and all-weather land fighter which, in turn, was developed from the original single-seat Venom day fighter and fighter-bomber.

The Sea Venom has power folding wings, catapult and arrester gear, is powered by a D.H. Ghost engine and has a fixed armament of four 20 mm. cannon.

The Venom has been illustrated and described in previous editions. The following are the principal versions of the Sea Venom :—

Sea Venom F. (A.W.) Mk. 20. Naval version of the Venom N.F. Mk. 2, in service with the Royal Navy as a two-seat all-weather fighter. Fitted with power-folding wings, catapult gear and arrester gear.

Sea Venom F. (A.W.) Mk. 21. Improved Mk. 20 with special combat equipment, power-jettisonable clear vision hood and power-operated controls. Fitted with two lightweight Martin-Baker Mk. 4 ejector seats of latest fully-automatic type. In service in the Royal Navy.

Sea Venom F. (A.W.) Mk. 22. Latest version. More powerful version of Ghost engine.

Sea Venom Mk. 52. Export version of Mk. 20 for French Navy. Built under licence in France by Sud-Aviation and named "Aquilon." Powered by Fiat-built D.H. Ghost 48 engine. First production Aquilon flew on March 25, 1954.

Sea Venom Mk. 53. Export version of Mk. 21 for Royal Australian Navy.

DIMENSIONS.—
Span 41 ft. 9 in. (12.7 m.).
Length (F.B. Mk 4) 33 ft. (10 m.)
Length (Sea Venom Mk. 21) 35 ft. 3 in. (10.7 m.).

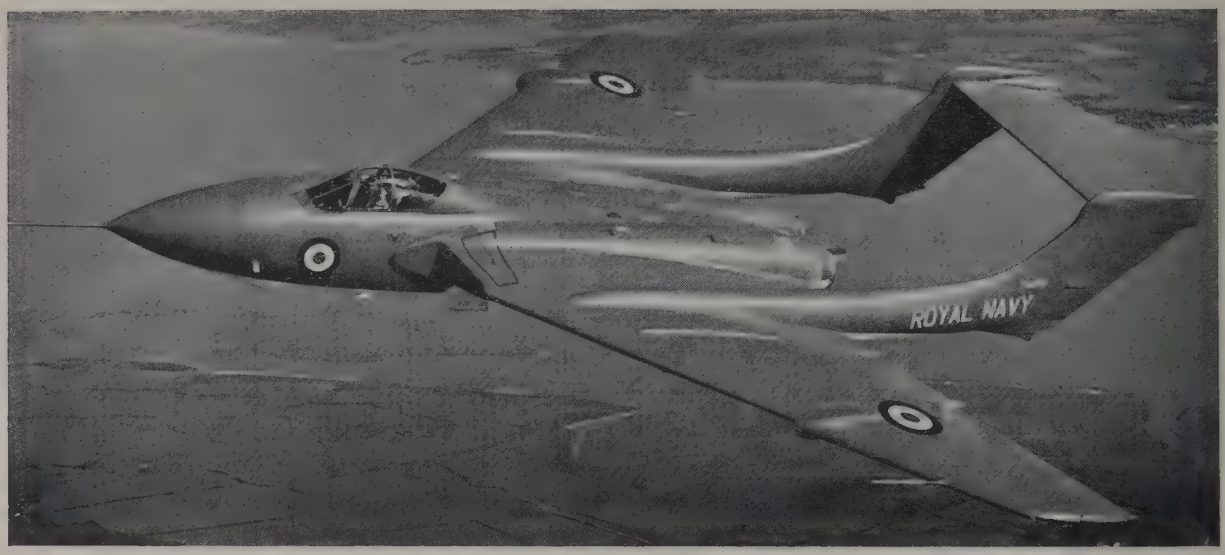
THE D.H. 110 SEA VIXEN.

The Sea Vixen is a two-seat day and night all-weather fighter which successfully completed its carrier trials in April, 1956 and is in production for the Royal Navy at de Havilland's Christchurch works. The production order was placed in January, 1955. It is powered by two Rolls-Royce Avon turbojet engines, can dive at supersonic speed, and is equipped with the latest electronic combat and navigational aids. Flight refuelling trials have been completed successfully by one of the prototypes.

The first fully-developed Sea Vixen with power-folding wings, long-stroke



The D.H. Sea Vemon F. (A.W.) Mk. 22 Two-seat Naval All-weather Fighter (D.H. Ghost turbojet engine).



The D.H. Sea Vixen F. (A.W.) Mk. I two-seat Naval All-weather Fighter (two Rolls-Royce Avon 200 Series engines).

landing gear and other changes flew on March 20, 1957, and the following details apply to this version :—

TYPE.—Two-seat Naval all-weather fighter.

WINGS.—Cantilever mid-wing monoplane. Sharply-swept wings fold hydraulically upward and inward through 110°. All-metal structure making extensive use of machined wing skins. Deeply-cambered leading-edges outboard of wing fences. Large Fowler-type flaps in sections on each side of tail booms are linked with tailplane. As flaps extend, rear portion of tailplane is deflected upward to cancel resulting trim change. Ailerons actuated by Hobson tandem-piston jacks.

NACELLE.—All-metal monocoque structure. Pointed nose section containing radar scanner hinges to starboard to reduce stowage length and for maintenance. Hydraulically-operated air-brake under centre of nacelle.

TAIL BOOMS.—All-metal structures of elliptical section, built integrally with fins.

TAIL UNIT.—All-metal centilever structure. Twin fins integral with tail booms. Twin rudders. All-moving "slab" tailplane mounted between top of fins, with variable gear ratio. When "flaps down" is selected, rear portion of tailplane is unlocked from front portion and deflected up to cancel trim change due to flap extension. Rudders and tailplane operated by Hobson tandem-piston jacks.

LANDING GEAR.—Retractable tricycle type. Long-stroke shock-absorbers. Hydraulic actuation. Steerable nose-wheel. Dunlop "Maxaret" anti-skid brakes. Tubeless tyres. Main wheel doors close when wheels down. Hydraulically-operated sting-type arrester hook under and between engine tailpipes. Wheel track 17 ft. 2½ in. (5.22 m.).

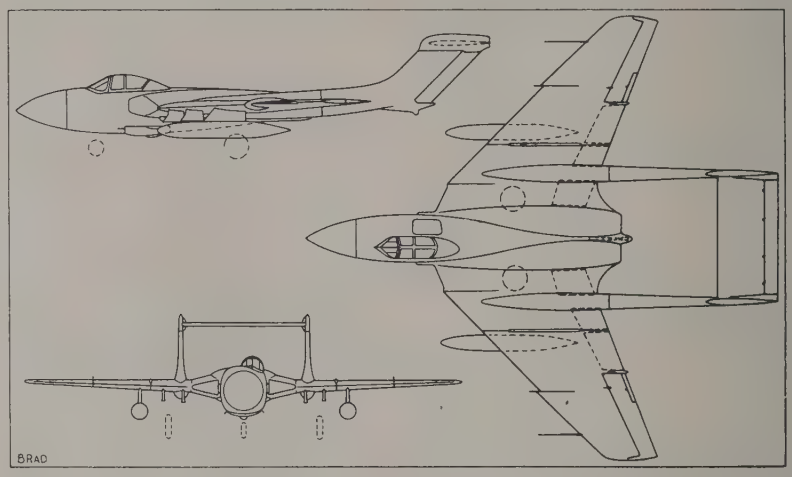
POWER PLANT.—Two Rolls-Royce Avon turbojet engines side-by-side in rear of nacelle, in fireproof bays. All skin above engines made up of removable access panels. Fuel in tanks between engine air intake ducts and in wings. Two 150 Imp. gallon (682 litre) auxiliary tanks can be carried under wings.

ACCOMMODATION.—Crew of two. Pilot under offset canopy to port, with Vee type windscreen. Observer totally enclosed in nacelle to starboard. Pressurised and air-conditioned cockpits. Martin-Baker Mk. 4 lightweight ejection seats.

ARMAMENT.—With two auxiliary fuel tanks, any of the following loads can be carried on underwing pylons: four de Havilland Firestreak missiles; four 500 lb. bombs; two Firestreaks and two 500 lb. bombs; two 500 lb. bombs and two clusters of six rockets each; or four clusters of rockets. No guns are fitted.

DIMENSIONS.
Span 50 ft. 0 in. (15.24 m.).
Length 53 ft. 6½ in. (16.31 m.).
Length (nose folded) 50 ft. 2½ in. (15.30 m.).
Height approx. 11 ft. (3.35 m.).
Width, wings folded, 22 ft. 3 in. (6.78 m.).
Height, wings folded, 14 ft. 11½ in. (4.55 m.).

WEIGHTS AND PERFORMANCE.—
No details available.



The D.H. Sea Vixen F. (A.W.) Mk. I Naval All-weather Fighter.

THE D.H. 106 COMET.

Production of the Comet is now concentrated on the long-range Series 4 and medium-range Series 4B versions of which 19 have been ordered by B.O.A.C. and six by B.E.A. The Series 4 and 4B are straightforward projections of the Comet 3 and supersede that model. They will incorporate all the improvements accumulated in six years of Comet development and operation, including 30,000 hours of airline service, and in a programme of research and testing which is without precedent in aeronautical engineering.

Brief details of the Civil versions of the Comet follow.

Comet 2E. Two Rolls-Royce Avon RA.9 turbojets (7,330 lb. = 3,320 kg. s.t.) in inboard nacelles; two Avon RA.29 turbojets (10,500 lb. = 4,767 kg. s.t.) in outboard nacelles. Two specially modified for B.O.A.C. to enable the airline's crews to build up experience with the RA.29 engines, of the type which will power the Comet 4. Delivered to B.O.A.C. in August, 1957.

Comet 3. Four Rolls-Royce Avon RA.29 turbojet engines (10,500 lb.=4,760 kg. s.t. each). Development prototype for Comet 4. Production not envisaged. First flight on July 14, 1954. Completed a round-the-world demonstration and service test flight in December, 1955. Originally had Avon RA.26 turbojets. Re-engined in 1957, to bring to Comet 4 standard.

Comet 4. Four Rolls-Royce Avon RA.29 turbojet engines (10,500 lb.=4,767 kg. s.t. each). Differs from the Series 3 in having a redesigned fuselage, increased power, reduced fuel consumption and increased tankage, resulting in improved range/payload capabilities. The Comet 4 will carry 60 first class passengers (capacity payload of 16,720 lb.=7,598 kg.) over a stage length of 3,000 statute miles (4,828 km.), allowing for reserves for climb, descent, head-winds, stand-off and diversions. Alternatively, it will carry 76 tourist class passengers (capacity payload of 19,361 lb. (8,782 kg.) over a stage length of 2,700 statute miles (4,345 km.) with reserves. First deliveries of the Comet 4 will be made in the latter part of 1958. Nineteen ordered by B.O.A.C.

Comet 4A. Projected medium-range version of Comet 4, to carry 70 first class or 92 tourist passengers over maximum stage lengths of 1,880-2,730 miles (3,025-4,395 km.). Fuselage lengthened by 40 in. (1,02 m.). wing span reduced by 7 ft. (2.13 m.), rear fuselage and tail reinforced to permit higher cruising speeds at lower altitudes. Superseded by Comet 4B.



The D.H. Comet 3 (four Rolls-Royce Avon RA.26 turbojet engines), the development prototype of the Comet 4 Airliner.

Comet 4B. Development of Comet 4A with fuselage lengthened by a further 38 in. (0.97 m.) to provide accommodation for 84 first-class or 99 tourist passengers over stages of 300-2,000 miles (800-3,220 km.). Wing nacelle fuel tanks deleted. To speed turn-around time on short routes, can have integral power-operated passenger stairway and built-in auxiliary power unit for engine starting, and to provide electrical power and air-conditioning services while at rest. Six ordered by B.E.A., for delivery in 1959-60.

In addition, the following military versions of the Comet exist :—

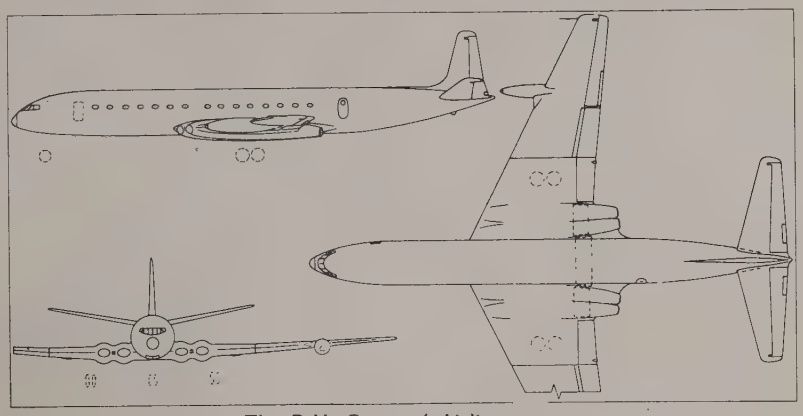
Comet 1A. Four D.H. Ghost 50 Mk. 2 engines. Two delivered to R.C.A.F. in May, 1953. Returned to England for extensive modification and flown back to Canada in 1957.

Comet 2. Four Rolls-Royce Avon Mk. 501 engines. Structurally unmodified. Being used for unspecified special duties by the Royal Air Force.

Comet T. Mk. 2. Four Rolls-Royce Avon Mk. 117 turbojets (7,300 lb.=3,311 kg. s.t. each). Re-designed fuselage. A.U.W. 120,000 lb. (54,433 kg.). Two supplied to R.A.F. Transport Command for crew training.

Comet C. Mk. 2. Generally similar to T. Mk. 2. Long-range mixed passenger/freight transport with strengthened cargo floor forward and 44 backward-facing seats aft of centre-section. Pressurised to operate at 45,000 ft. (13,725 m.). Eight in service with R.A.F. Transport Command.

Details of the main features and performance of the Comet 4 and 4B released to date are as follows:—



The D.H. Comet 4 Airliner.

TYPE.—Four-engined Jet Airliner.

WINGS (Series 4).—Low-wing cantilever monoplane with moderate sweepback, with two jet engines accommodated in each stub-wing, passing through the front and rear spar webs. Integral and bag-type fuel tanks and thermal de-icing. Air brakes are fitted. Plain flaps outboard of the engines and split flaps inboard, with hydraulic operation. Extensive use of Redux metal-to-metal bonding. Chord 29 ft. 6 in. (9.0 m.) at root, 6 ft. 9 in. (2.06 m.) at tip. Gross wing area 2,121 sq. ft. (197 m.^{2}).

WINGS (Series 4B).—Basically as for Comet 4, but with reduced span. Aspect ratio 5.65. Gross wing area 2,066 sq. ft. (191.94 m.^{2}).

FUSELAGE.—Of circular cross section, 10 ft. (3.05 m.) in diameter throughout length of cabin. A pressure dome seals the aft end of the cabin. Redux bonding used extensively.

TAIL UNIT.—Cantilever monoplane tailplane and single fin and rudder. Tailplane span 47 ft. 5 in. (14.45 m.).

LANDING GEAR.—Retractable tricycle type of de Havilland design. Each main unit carries a four-wheel bogie retracting outwards into wings. Doors retract when undercarriage is down. Twin-wheel nose unit is steerable and retracts backwards into fuselage. Hydraulic retraction. Wheel track (shock-strut centres) 28 ft. 2 in. (8.58 m.). Wheel base (shock-strut centres) Comet 4 46 ft. 8 in. (14.22 m.).

POWER PLANT.—Four Rolls-Royce Avon RA.29 turbojet engines (10,500 lb.=4,767 kg. s.t. each). Hinged panels below wings expose whole installations for easy servicing from ground. Quickly-detachable air intake and tail pipe connections and special disconnect-joints in engine control connecting rods. Installation is split into three temperature zones, each zone being



The Comet T. Mk. 2 for R.A.F. Transport Command (four Rolls-Royce Avon Mk. 117 turbojet engines).

separated by fire-proof bulkhead and having its own ventilators and fire-extinguishing system. Fuel in integral and flexible bag-type wing tanks, flexible bag tanks in centre-section and projecting leading-edge tanks (Comet 4 only) with pressure refuelling. Fuel capacity 8,860 Imp. gallons (40,277 litres) in Comet 4, 7,890 Imp. gallons (35,868 litres) in Comet 4B.

ACCOMMODATION (Series 4).—Flight deck forward, with accommodation for two pilots with full dual control, flight engineer, and radio-operator/navigator. Seating capacity 60/76 passengers. Flight deck, cabin and freight compartments pressurised to $8\frac{3}{4}$ lb./sq. in. (0.6 kg./cm.²) by air tapped from the engine compressors, giving a cabin altitude of 8,000 ft. (2,436 m.) when the aircraft is at 40,000 ft. (12,120 m.). Cabin 55 ft. 10 in. long, max. 9 ft. 9 in. wide and max. 6 ft. 6 in. high (17.01 × 2.96 × 1.98 m.). Galley, toilet, wardrobe and dressing amenities. Main passenger door in port side at end of cabin, and crew door forward in starboard side; both open inwards and measure 4 ft. 8 in. × 2 ft. 6 in. (1.43 m. × 0.761 m.). Freight capacities: rear hold floor 155 cub. ft. (4.387 m.³); rear hold (under floor) 240 cub. ft. (6.792 m.³); front hold (below floor) 150 cub. ft. (4.245 m.³).

ACCOMMODATION (Series 4B.—Basically as Comet 4, but fuselage lengthened by 78 in. (1.98 m.) to accommodate 84 first class or 99 tourist passengers.

DIMENSIONS (Series 4).—
Span 115 ft. (35 m.).
Length 111 ft. 6 in. (33.99 m.).
Height (on ground—over fin) 28 ft. $4\frac{1}{2}$ in. (8.65 m.).

DIMENSIONS (Series 4B).—
Span 107 ft. $9\frac{1}{8}$ in. (32.86 m.).
Length 118 ft. (35.97 m.).
Height 28 ft. 5 in. (8.66 m.).

WEIGHTS (Series 4).—
Basic operational weight 72,595 lb. (32,930 kg.).
Capacity payload (60 seats) 16,720 lb. (7,598 kg.).
Capacity payload (76 seats) 19,361 lb. (8,782 kg.).
Weight loaded 152,500 lb. (69,235 kg.).
Max. landing weight 113,000 lb. (51,260 kg.).

WEIGHTS (Series 4B).—
Basic operational weight 73,816 lb. (33,482 kg.).
Max. payload 21,968 lb. (9,964 kg.).
Max. loaded weight 152,500 lb. (69,235 kg.).
Max. landing weight 113,000 lb. (51,260 kg.).

PERFORMANCE (Series 4).—
Cruising speed 500 m.p.h. (800 km.h.).
Take-off field length at max. A.U.W. 6,380 ft. (1,945 m.).
Landing distance from 50 ft. (15.25 m.) 3,520 ft. (1,073 m.).
Max. still air range with 9,155 lb. (4,152 kg.) payload at 472 m.p.h. (760 km.h.) at 38,850 ft. (11,840 m.), no reserves, 4,671 miles (7,517 km.).
Range, still air, with max. payload, no reserves, 3,774 miles (6,074 km.).

PERFORMANCE (Series 4B).
Mean cruising speed at 23,500 ft. (7,160 m.) in I.S.A. conditions 532 m.p.h. (856 km.h.).
Take-off field length at max. A.U.W. 6,500 ft. (1,980 m.).
Range, still air, with max. payload, at mean cruising speed of 532 m.p.h. (856 km.h.), 2,000 miles (3,220 km.).

THE D.H. 104 DOVE.

R.A.F. Name: Devon.

Royal Navy Name: Sea Devon.

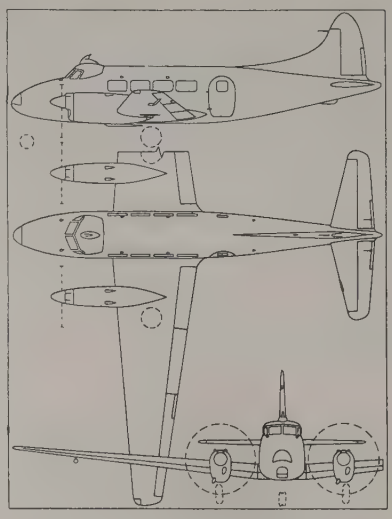
Nearly 500 Dove light transports are now operating in a variety of rôles all over the World. The standard commercial model has accommodation for eight/eleven passengers, but variants have been designed for survey, post-control, executive and ambulance duties.

A military version, known as the Devon C. Mk. 1, is in service with the Royal Air Force and overseas. The Royal Navy has 13 similar Sea Devon C. Mk. 20 aircraft, of which the last three were delivered in 1956.

The current basic civil versions of the Dove are as follows :—



The D.H. Dove (two 355 h.p. D.H. Gipsy Queen 70 Mk. II engines).



The D.H. Dove Light Transport.

Series 5. Two 380 h.p. D.H. Gipsy Queen 70 Mk. 2 engines. Installation of this engine requires no modifications to the standard Dove engine bearer structure, pipe lines and control runs. Twenty per cent. increase in pay-load over 500 mile (800 km.) stage as compared with the earlier Series 1.

Series 6. Same as Series 5 but with special executive interior.

TYPE.—Twin-engined eight/eleven-passenger Light Transport.

WINGS.—Cantilever low-wing monoplane. Piercy aerofoil section, max. thickness at 35% chord. Root chord 8 ft. 8 in. (2.64 m.); tip chord 2 ft. $6\frac{1}{2}$ in. (.77 m.); aspect ratio 9.7; incidence 2 degrees, dihedral (top front spar) 4 degrees. All-metal structure with stressed aluminium-alloy Redux-bonded skin riveted to spars and ribs. Mass-balanced aluminium-alloy ailerons. Trim-tab in each, adjustable on ground only. Pneumatically-operated plain-hinge flaps in two sections each side. Total aileron area 10.9 sq. ft. (1 m.²). Total flap area 19.8 sq. ft. (1.84 m.²). Gross wing area 335 sq. ft. (31.12 m.²).

FUSELAGE.—Oval-section monocoque structure with Redux-bonded stressed aluminium-alloy skin.

TAIL UNIT.—Cantilever monoplane type. Light-alloy structure with metal-covered fixed surfaces and fabric-covered elevators and rudder. Tailplane adjustable for incidence on ground. Elevators interchangeable left and right. Controllable metal trim-tabs in rudder and elevators. Fin area 20.4 sq. ft. (1.89 m.²). Rudder area 13.75 sq. ft. (1.27 m.²). Tailplane area 35.46 sq. ft. (3.28 m.²). Elevator area (total) 24.5 sq. ft. (2.27 m.²).

LANDING GEAR.—Retractable tricycle type. Rubber-in-compression shock-absorber legs interchangeable left and right. Dunlop wheels, tyres and brakes. Nose-wheel on Lockheed air-oil shock-absorber strut. Dunlop nose-wheel with Marstrand two track tyre. Pneumatic retraction, with separate emergency system. Track 13 ft. 8 in. (4.16 m.). Wheel base 13 ft. 0 in. (3.96 m.).

POWER PLANT.—Two de Havilland Gipsy Queen 70 Mk. 2 geared and supercharged six-cylinder in-line inverted air-cooled engines rated at 355 b.h.p. at 4,250 ft. (1,296 m.) and with 380 b.h.p. available for take-off. Engines complete with oil tank and all accessories form self-contained units which are quickly detachable and interchangeable right and left. D.H. Hydromatic 1,000 three-blade constant-speed feathering airscrews 7 ft. 6 in. (2.28 m.) diameter. Total fuel capacity 168 Imp. gallons (764 litres).

ACCOMMODATION.—Enclosed cockpit seating pilot and co-pilot/radio-operator side-by-side with dual controls. Main cabin, ventilated and sound-proofed, has accommodation for eight passengers in four seats on each side of central aisle. Main entry door, 2 ft. 3 in. (0.68 m.) from ground on port side aft of rear cabin bulkhead, with another door into cabin. Toilet on starboard side of vestibule opposite main entry door. Rear cabin bulkhead and lavatory can be removed to provide a ninth passenger seat. In eleven-passenger version bulkhead aft of vestibule removed and two further seats installed. Main cabin 11 ft. 9 in. long × 5 ft. $2\frac{1}{2}$ in. wide × 4 ft. 6 in. high (3.58 m. × 1.58 m. × 1.37 m.). Volume 246 cub. ft. (6.96 m.³). Two emergency exits in roof. Forward luggage compartment under floor of cockpit with volume of 22 cub. ft. (0.62 m.³). Max. load 300 lb. (136 kg.). Aft luggage compartment (on eight-nine seat aircraft) with volume of 45 cub. ft. (1.27 m.³). Max. load 600 lb. (272 kg.). On eleven-seat aircraft 30 cub. ft. (0.85 m.³) luggage space available aft of rear seats.

DIMENSIONS.—
Span 57 ft. 0 in. (17.40 m.).
Length 39 ft. 3 in. (11.96 m.).
Height (over rudder) 13 ft. 4 in. (4.06 m.).

WEIGHTS AND LOADINGS (Series 5 and 6).—
Tare weight (including radio) 5,878 lb. (2,667 kg.).
Crew (2) 330 lb. (150 kg.).
Fuel (for 400 miles = 645 km.) 845 lb. (383 kg.).
Oil 84 lb. (38 kg.).
Payload 1,663 lb. (754 kg.).
Weight loaded 8,800 lb. (3,992 kg.).
Wing loading 26.3 lb./sq. ft. (128.2 kg./m.²).
Power loading 11.58 lb./h.p. (5.66 kg./h.p.).

PERFORMANCE (Series 5 and 6).—
Max. weak mixture cruising speed at 8,000 ft. (2,440 m.) 202 m.p.h. (325 km.h.).
Cruising speed at 60% M.E.T.O. power at 8,000 ft. (2,440 m.). 179 m.p.h. (288 km.h).
Rate of climb at sea level 920 ft./min. (4.67 m./sec.).
Rate of climb on one engine at M.E.T.O. power 220 ft./min. (1.12 m./sec.).
Stage length with 1,500 lb. (680 kg.) payload without extra tanks under V.F.R. conditions 660 miles (1,050 km.).
Take-off distance to 50 ft. (15 m.) 810 yds. (740 m.).
Landing distance from 50 ft. (15 m.) 640 yds. (585 m.).
Fuel consumption at cruising speed 27.3 Imp. gallons per hour (124 litres per hour) (6.55 m.p.g. = 2.32 km. per litre).
Fuel consumption at max. weak mixture cruising speed 35 Imp. gallons per hour (159 litres per hour) (5.77 m.p.g. = 2.04 km. per litre).

EDGAR PERCIVAL

EDGAR PERCIVAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: STAPLEFORD AERODROME, ROMFORD, ESSEX.

Directors: E. W. Percival, F.R.Ae.S., M.S.A.E., M.I.Ae.E., A.F.I.Ae.S., M.I. Mar.E., F.R.S.A. (Chairman and Managing) and D. Ross, C.A.

Edgar Percival, an Australian pilot and engineer, was the founder of the original Percival Aircraft Company in 1932. For this company he designed the well-known Percival Gull Series of aircraft, examples of which won The King's Cup in 1936, 1937, 1938 and 1955. Percival Gulls also made many notable long-distance flights before the 1939-45 war and a developed military form of the Gull, known as the Proctor, was produced in large numbers during the war.

His new company has produced an aircraft known as the EP.9, which is intended mainly to meet agricultural requirements but is also suitable for many other applications. In addition to spraying, dusting, top-dressing and seeding, it can be used for supply dropping, ambulance work, freighting, passenger carrying, communications, photography and geophysical survey. For supply dropping, the rear loading door can be removed without effect on performance or handling.



The Edgar Percival EP.9 (270 h.p. Lycoming GO-480 engine).

THE EDGAR PERCIVAL EP.9.

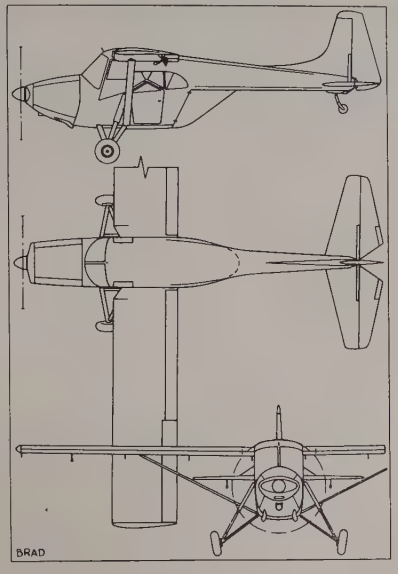
The prototype of the EP.9 made its first flight on December 21, 1955. The first aircraft of a production batch of 100 flew on June 30, 1956.

The EP.9 is capable of fulfilling a number of different roles, for some of which specialised equipment is either built-in or can be easily installed. The various versions of the basic aircraft are distinguished as follows:—

EP.9	Freighter.
EP.9A	Top-dressing and seeding aircraft.
EP.9B	Crop-spraying aircraft.
EP.9C	Crop-dusting aircraft.
EP.9D	Universal hopper version.
EP.9E	Passenger aircraft.
EP.9F	Ambulance.

All models may be fitted with floats, ski or wheel landing gear.

By July, 1957, EP.9's had been sold to operators in Australia, New Zealand, Canada, Libya, Germany, France and Borneo. About half of the total sold were the six-seat passenger version with removable seats for freight-carrying



The Edgar Percival EP.9.

TYPE.—Single-engined General purpose monoplane.

WINGS.—High-wing braced monoplane. Wing section developed from a laminar flow section. Aspect ratio 8.31. Chord 5 ft. 3½ in. (1.61 m.). Dihedral 1°. Incidence 1°. Single-spar light alloy structure, with stressed skin covering. Light alloy stressed skin slotted flaps and slotted ailerons. Total area of ailerons 22.4 sq. ft. (2.08 m.²). Total area of flaps 29.6 sq. ft. (2.75 m.²). Gross wing area 227.6 sq. ft. (21.14 m.²).

FUSELAGE.—Welded steel-tube structure, fabric-covered.

TAIL UNIT.—Braced monoplane type. Light alloy structure with stressed skin covering. Single bracing rod each side from fin to tailplane. Areas: fin and rudder 25 sq. ft. (2.32 m.²), tailplane and elevators 42.8 sq. ft. (3.98 m.²). Tailplane span 14 ft. 0 in. (4.27 m.).

LANDING GEAR.—Fixed tail-wheel type. Edgar Percival rubber-in-compression shock absorbers. Goodyear wheels and Goodyear single plate disc brakes. Wheel track 10 ft. 6 in. (3.2 m.). Wheelbase 20 ft. 1 in. (6.1 m.).

POWER PLANT.—One 270 h.p. Lycoming GO-480-B1B six-cylinder horizontally-opposed air-cooled engine driving a Hartzell two-blade metal constant-speed airscrew. Fuel in two tanks in wing roots, each with capacity of 28 Imp. gallons (127 litres). Oil capacity 2½ Imp. gallons (11.3 litres).

ACCOMMODATION.—Enclosed cabin seating pilot and five passengers, or pilot, one passenger beside pilot and any one of various alternative loads in 185 cub. ft. (5.24 m.³) of usable space aft of front seats. Entrance doors to front seats on port and starboard sides. Entrance door to rear of cabin on port side, with large sideways-hingeing rear door for freight loading.

DIMENSIONS.—
Span 43 ft. 6 in. (13.26 m.).
Length 29 ft. 6 in. (8.99 m.).
Height 8 ft. 9 in. (2.67 m.).

WEIGHTS.—
Weight empty 2,010 lb. (910 kg.).
Weight loaded (normal) 3,550 lb. (1,612 kg.).
Weight loaded (agricultural category) 4,150 lb. (1,884 kg.).
Useful load (normal) for 350 mile (560 km.) range 1,238 lb. (762 kg.).
Useful load (normal) for 150 mile (240 km.) range 1,378 lb. (626 kg.).
Useful load (agricultural category) for 150 mile (240 km.) range 1,978 lb. (898 kg.).

PERFORMANCE (full load -normal category).—
Max. speed 146 m.p.h. (233.6 km.h.).
Max. cruising speed 128 m.p.h. (205 km.h.).
Econ. cruising speed 122 m.p.h. (195 km.h.).
Min. stalling speed 38 m.p.h. (61 km.h.).
Max. rate of climb 1,120 ft./min. (342 m./min.).
T.O. run, grass field, 5 m.p.h. (8 km.h.) wind 105 yds. (96 m.).
Range 580 miles (934 km.).

PERFORMANCE (full load, agricultural category).—
Max. speed 141 m.p.h. (225.6 km.h.).
Max. cruising speed 124 m.p.h. (198 km.h.).
Econ. cruising speed 118 m.p.h. (189 km.h.).
Min. stalling speed 41 m.p.h. (65.6 km.h.).
Max. rate of climb 908 ft./min. (277 m./min.).
T.O. run, grass field, 5 m.p.h. (8 km.h.) wind 180 yds. (165 m.).



The Edgar Percival EP.9 (270 h.p. Lycoming GO-480 engine).

ENGLISH ELECTRIC

THE ENGLISH ELECTRIC COMPANY LTD.

HEAD OFFICE: QUEEN'S HOUSE, KINGSWAY, LONDON, W.C.2.

WORKS, AIRCRAFT DIVISION: PRESTON, LANCS.

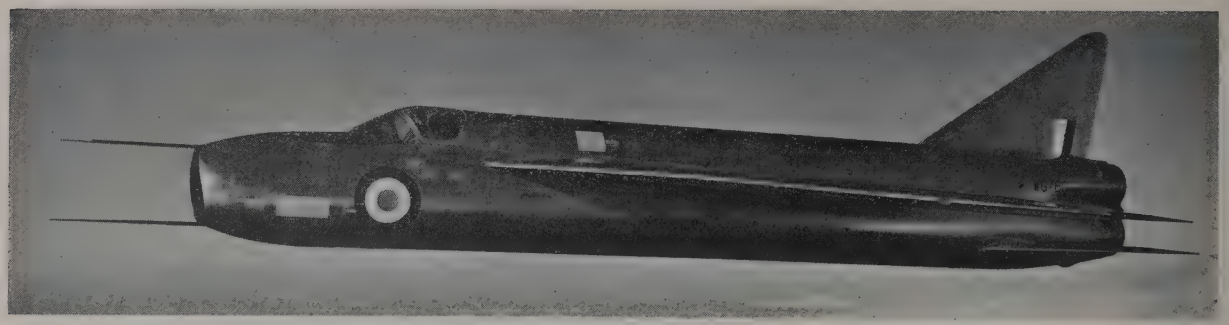
Directors: Sir George H. Nelson, F.C.G.I., M.I.Mech.E., M.I.E.E. (Chairman), H. G. Nelson, M.I.C.E., M.I. Mech.E., M.I.E.E. (Managing Director), Sir Edward Crowe, K.C.M.G., P. Horsfall, Sir Charles P. Snow, C.B.E., Ph.D., Sir Edward Wilshaw, K.C.M.G., Sir John Woods, G.C.B., M.V.O., Lord Caldecote, D.F.C., and Godfrey Phillips.

Chief Engineer, Aircraft Division: F. W. Page, B.A., F.R.Ae.S.

Chief Designers: F. D. Crowe, B.Sc. (Eng.), A.F.R.Ae.S. and A. E. Ellison, A.M.I.Mech.E.

The English Electric Co., Ltd. was formed in 1918 by the amalgamation of Dick Kerr & Co., Ltd., of Preston; the Coventry Ordnance Works, Ltd., of Coventry; the Phoenix Dynamo Manufacturing Co., Ltd., of Bradford; Willans & Robinson, Ltd., of Rugby; and the Siemens Dynamo Works of Stafford. The first three companies mentioned had had considerable experience in aircraft design and construction, dating back in the case of the Coventry Ordnance Works to 1911. Dick Kerr and Phoenix Dynamo between them were the largest producers of seaplanes and flying-boats in World War I.

The then newly-formed English Electric Co., Ltd., retained an aircraft department and continued to build flying-boats of its own design until 1926.



The English Electric P.1A (two Armstrong Siddeley Sapphire turbojet engines).

Aircraft manufacture was resumed at Preston in 1938, and after the war, English Electric established its own technical and design organization, the first product of which was the Canberra twin-jet bomber. The Canberra is in production for the Royal Air Force both by English Electric and by Short Bros. & Harland, Ltd., has been supplied to the air forces of Ecuador, Venezuela, Peru and India, and was ordered for the Royal New Zealand Air Force in 1957. A number have also gone to the Centre d'Essais en Vol in France.

The Canberra is also being built at the Australian Government factory at Fishermen's Bend, Melbourne, for the R.A.A.F., and in the United States by The Martin Company, under the U.S.A.F. designation B-57. For further details of the B-57 see under "Martin" (U.S.A.).

Following the success of the Canberra, English Electric designed the P.1 fighter which is now in production for the Royal Air Force as Fighter Command's last piloted interceptor.

The company also announced in May, 1957 that it has formed a civil aircraft project design team at Warton aerodrome, near Preston, as an extension of the Aircraft Division's work, but no details of its civil projects are yet available.

Details of the Thunderbird surface-to-air guided missile for which the English Electric Guided Weapons Division at Luton and Stevenage have a large production contract, appear in the "Guided Missiles" section of this work.

THE ENGLISH ELECTRIC P.1.

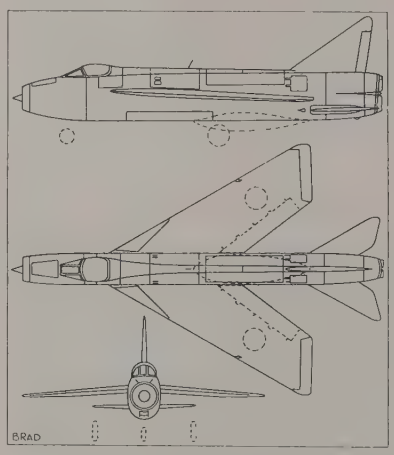
The P.1 is under development for the Royal Air Force as a highly supersonic all-weather day and night interceptor which will be armed with de Havilland Firestreak air-to-air missiles. It is planned to be the last piloted interceptor used by R.A.F. Fighter Command. Two versions have been announced, as follows.

P.1A. Three prototypes only, each powered by two Armstrong Siddeley Sapphire turbojets. Two for intensive flying trials and one for structure testing to destruction in ground rig. First flight August 4, 1954.

P.1B. Three prototypes and 20 pre-production aircraft will be of this type, which has also been ordered into series production. Two Rolls-Royce Avon turbojets with reheat. New air intake with pointed centre-body and other changes. First flight April 4, 1957.

The P.1 had its origin in a specification for a manned supersonic research aircraft issued by the Ministry of Supply in 1947 under the designation E.R.103. English Electric submitted their proposal in 1949, having designed their project so that it would be capable of development into a fighter, and were awarded a prototype contract. This was followed by Specification F.23 in 1953, under which the P.1 was re-engineered as a complete "weapon system."

In 1950, the company built the first privately-owned transonic-supersonic wind tunnel in the country to assist in the development of the P.1, and Short Brothers and Harland Ltd. were given a contract for the S.B.5 research aircraft to test the proposed design at comparatively low speeds.



The English Electric P.1B.

The original unarmed prototype P.1A flew on August 4, 1954, exceeding the speed of sound during its first flight without the pilot being aware of the fact. Soon afterwards it went supersonic in a climb and by April, 1957 the two flying prototypes had made more than 500 flights, in which supersonic speeds in level, climbing and turning flight were regarded as normal practice.

Subsequent modifications to the first prototype include the fitting of developed Sapphire turbojets with reheat, and an extended wing leading-edge near the tips, with conical camber to improve the operational ceiling and range at subsonic and low supersonic speeds.

The second prototype P.1A carries two 30 mm. Aden guns in its forward fuselage and additional operational equipment. A bulged fairing, reported to be for the alternative installation of an auxiliary rocket motor or an external fuel tank, has been fitted under its rear fuselage.

It is expected that the extended wing leading-edge and under-fuselage pack will be incorporated eventually on the P.1B, of which the first prototype flew on April 4, 1957. The prototypes and each of the 20 pre-production aircraft of this series will be used for intensive development of a particular facet of supersonic interception, such as the navigation aids, radio, armament, automatic pilot, engines, radar, handling and operational trials.

Air Marshal Sir Thomas Pike, A.O.C.-in-C. of Fighter Command, has said that the P.1 has exceeded 1,000 m.p.h. (1,610 km.h.) in level flight and will be capable eventually of 1,500 m.p.h. (2,415 km.h.). It can cruise economically on one engine.

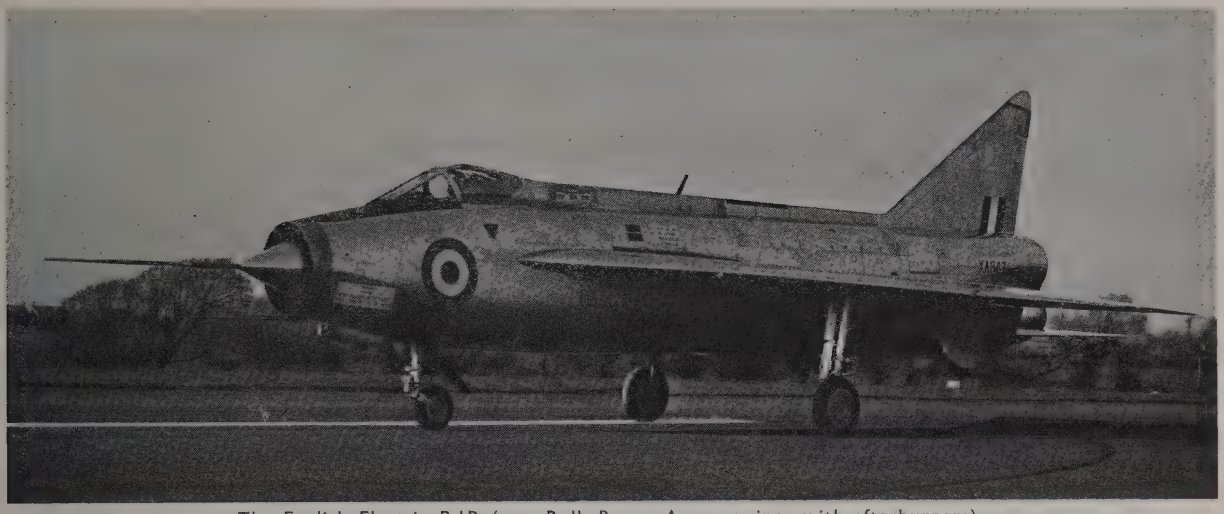
The following details apply to the P.1B prototype.

TYPE.—Single-seat Supersonic All-weather Interceptor.

WINGS.—Cantilever mid-wing monoplane. Sweepback 60°. Thickness/chord ratio approximately 5%. All-metal structure. Ailerons, which extend across wing-tips



The English Electric P.1B two Rolls-Royce Avon engines with afterburners).



The English Electric P.1B (two Rolls-Royce Avon engines with afterburners).

at right-angles to fuselage, are horn-balanced on prototypes, but will be inset on production aircraft. Fore-and-aft notches in leading-edge in lieu of fences. Large area-increasing flaps from wing trailing-edges.

Fuselage.—Parallel-section all-metal structure designed in full knowledge of the area rule. Air-brakes on upper part of fuselage near junction of fin leading-edge.

Tail Unit.—Cantilever monoplane type. All-metal structure. Low-set one-piece all-moving tailplane follows wing shape. Delta-shape fin and rudder, without trim-tab. Tailplane span 14 ft. 6 in. (4.42 m.).

Landing Gear.—Retractable tricycle type. of British Messier design. Main units retract outwards into wings. Hydraulically-steerable nose-wheel retracts forward into fuselage. Dunlop wheels, tyres and Maxaret brakes. Tyre pressure 280 lb./sq. in. (19.7 kg./cm.^{2}). Wheel track 12 ft. 9.3 in. (3.89 m.).

Power Plant.—Two Rolls-Royce Avon turbojet engines with reheat, staggered one above the other in the fuselage, and with variable-area nozzles. Lower engine is well forward of upper one. Integral fuel tanks in wings.

Accommodation.—Enclosed cockpit for pilot fitted with rearward-hingeing canopy and Martin-Baker Mk. 3 ejection seat. Cockpit pressurised and refrigerated.

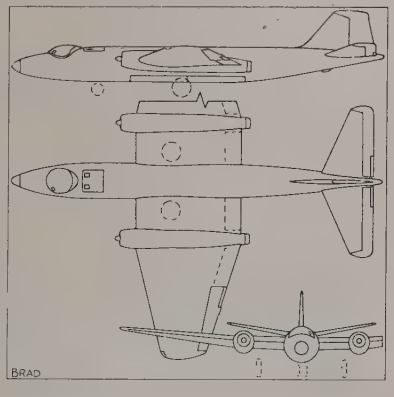
Armament.—Provision for two 30 mm. Aden cannon and two de Havilland Firestreak air-to-air missiles on pylons projecting laterally from fuselage.

Dimensions (P.1B).—
Span 34 ft. 10 in. (10.61 m.).
Length 50 ft. 0 in. (15.24 m.).
Height 17 ft. 6 in. (5.33 m.).

Weights and Performance.—
No details available.

THE ENGLISH ELECTRIC CANBERRA.

Designed originally to Specification B.3/45, the Canberra is powered by two Rolls-Royce Avon turbojet engines. The first prototype (VN799) flew for the first time on May 13, 1949. Deliveries of production Canberras to the Royal Air Force began in January, 1951 and it was announced in January, 1957 that more than 500 had then been built by English Electric. Many others have been produced by Short Brothers and Harland, A. V. Roe, Handley Page and, under licence, by Martin in America and the Department of Defence Production in Australia.

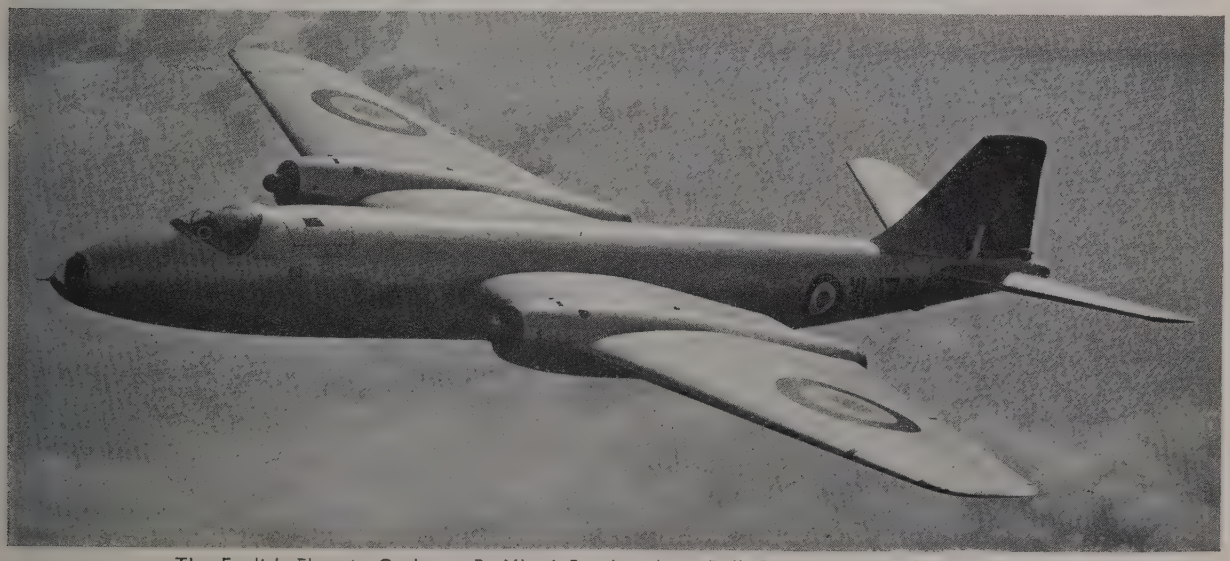


The English Electric Canberra B. Mk. 6.

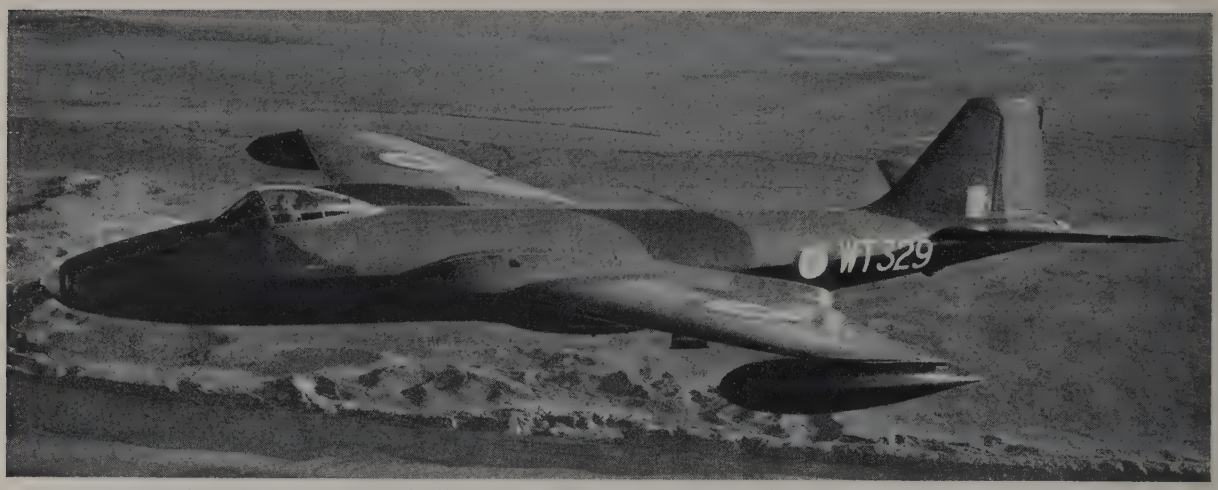
Canberras have been used as flying test-beds for numerous engines including the Bristol Olympus and D.H. Gyron Junior turbojets, and the D.H. Spectre and Napier Double Scorpion liquid-propellant rocket motors. A Canberra powered by two Bristol Olympus engines set up a World's Height Record of 65,876 ft. (20,079 m.) on August 29, 1955. Almost exactly two years later, on August 28, 1957, another Canberra powered by two Rolls-Royce Avon turbojets and a Napier Double Scorpion rocket motor set up a new World's Height Record at 70,000 ft. (21,336 m.). The Canberra also holds many officially-recognised point-to-point speed records.

Canberra B. Mk. 1. This designation refers only to the first four aircraft built. These were two-seat medium bombers, with "solid" nose. The second aircraft had Rolls-Royce Nene engines for experimental flying, the other three being powered by Rolls-Royce Avons.

Canberra B. Mk. 2. Two Rolls-Royce Avon 1 engines, with cartridge-operated turbo-starters. First production version, superseded by the B. Mk. 6. Three-seat medium bomber, with transparent nose cone. Cabin pressurisation from engine compressors in place of two-stage blower on Mk. 1. Crew consists of pilot, navigator/plotter and observer, the two latter being trained navigators. Former navigates by radar on to target, latter acts as



The English Electric Canberra B. Mk. 6 Bomber (two Rolls-Royce Avon turbojet engines).



The English Electric Canberra B.(I) Mk. 8 Night Interdictor (two Rolls-Royce Avon turbojet engines).

bomb-aimer over target. Radio is pilot operated.

Canberra P.R. Mk. 3. Similar to the B. Mk. 2, but carries equipment for high altitude photographic reconnaissance, and lacks the offset bomb-aiming panel in the transparent nose cap. Length 66 ft. 8 in. (20.3 m.). Superseded by the P.R. Mk. 7.

Canberra T. Mk. 4. Trainer version of B. Mk. 2. Crew of three, comprising a pupil and instructor seated side-by-side with dual controls and a navigator behind.

Canberra B. Mk. 5. Target marker version of B. Mk. 2. Solid nose with large optically-flat bomb-aimer's panel beneath nose. Not put in production.

Canberra B. Mk. 6. Similar to Mk. 2 but with more powerful Avon engines and additional fuel capacity. Now superseded by the B.(I) Mk. 8.

Canberra B. (I.) Mk. 6. Interim night interdictor version of the B. Mk. 6, pending delivery of the B. (I.) Mk. 8. Armament consists of under-wing bombs and a 4 × 20 mm. gun pack under the fuselage.

Canberra P.R. Mk. 7. Similar to Mk. 3 but with more powerful Avon engines and additional fuel capacity.

Canberra B. (I.) Mk. 8. Long-range Night Interdictor or High-altitude Bomber and Target Marker, and readily convertible from one rôle to the other. For interdictor duties a heavy forward-firing armament, consisting of four 20 mm. cannon, controlled by the pilot, is carried in a detachable fairing beneath the bomb-bay, while a variety of weapons can be carried under the wings. Pilot's cockpit with fighter-type canopy offset slightly to port, navigator's position in nose of fuselage. Same power-plant and increased fuel capacity as in Mks. 6 and 7. First B. (I.) Mk. 8 flew on July 23, 1954.

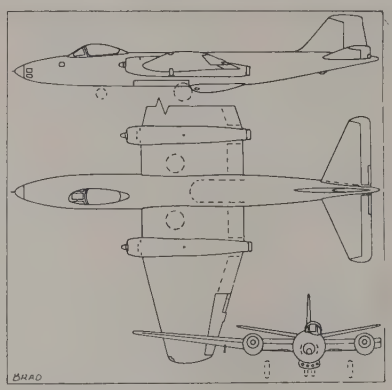
Canberra P.R. Mk. 9. High-altitude photographic reconnaissance aircraft to replace the P.R.7. Span increased by 4 ft. (1.22 m.) and chord of centre-section of wing inboard of nacelles extended. Offset fighter canopy as in B. (I.) Mk. 8. Fairey powered controls. Powered by new mark of Rolls-Royce Avon engine of unspecified output. P.R. Mk. 9 aircraft for the R.A.F. are built by Short Brothers and Harland, Ltd.

Canberra B. Mk. 20. Tactical bomber built in Australia and modified to meet R.A.A.F. operational requirements. Powered by two Australian-built Rolls-Royce Avon engines. First B. Mk. 20 flew for the first time on May 29, 1953.

The following details apply particularly to the B. Mk. 2 and B. Mk. 6, but are generally applicable to all versions :—

TYPE.—High-altitude Medium Bomber.

WINGS.—Cantilever mid-wing monoplane. Symmetrical high-speed aerofoil. Dihedral, inner wing (to engine nacelle) 2°, outer wing 4° 21′. Root chord 19 ft. (5.8 m.). Tip chord 7 ft. 8 in. (2.34 m.). Sweepback on



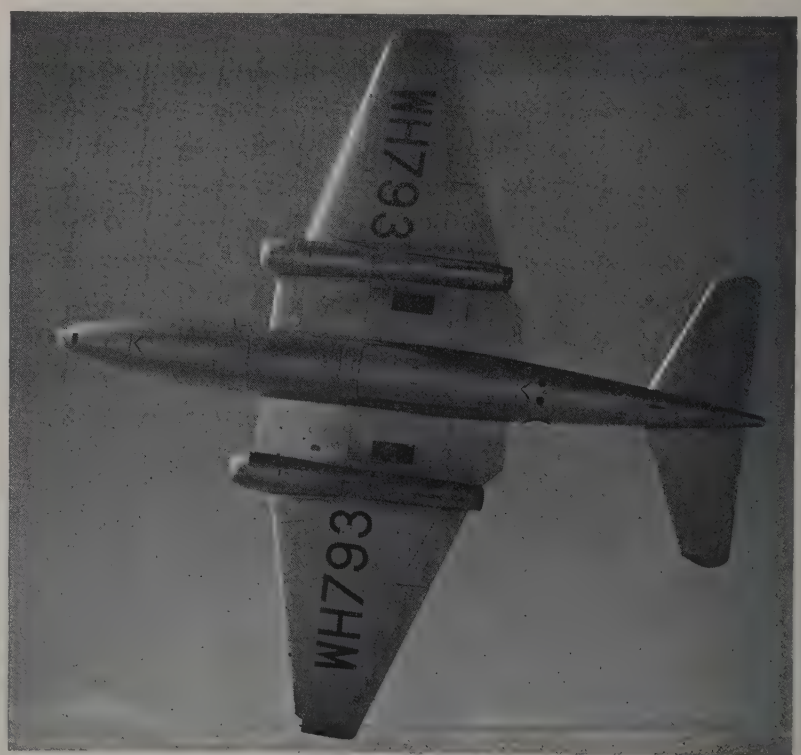
The English Electric Canberra B Mk. 8.

leading-edge (outer wing) 13 degrees, 53 minutes. Sweepforward on trailing-edge (outer wing) 19 degrees 53 minutes. All-metal single-spar structure with continuous main spar through fuselage. Irving-Westland pressure-balanced ailerons with spring-tabs in each. Four hydraulically-operated split trailing-edge flaps. "Finger-tip" type air brakes in top and bottom wing surfaces. Gross wing area 960 sq. ft. (89 m.²).

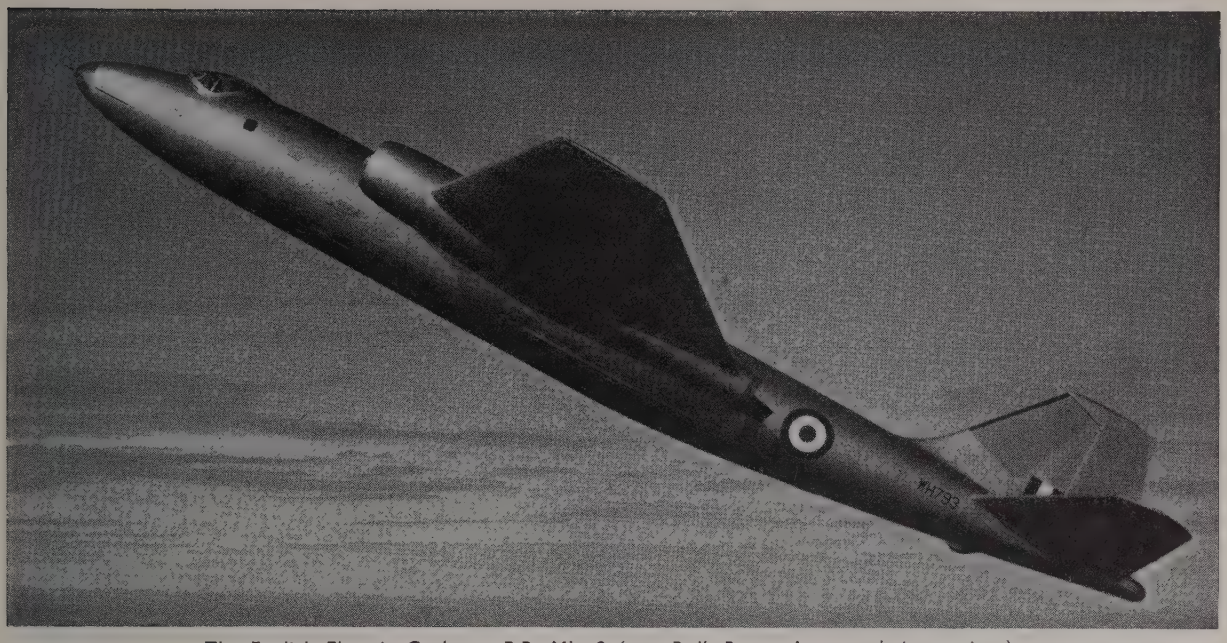
FUSELAGE.—All-metal semi-monocoque structure. Pressure bulkhead at rear of cockpit. Centre fuselage divided horizontally, with bomb-bay in lower compartment. Bomb doors, hydraulically-operated with remote selection, fitted with rollers which slide in curved tracks to retract into fuselage. All controls, pipe-lines and wires are jointed at the main fuselage transport joints to permit an easy break-down into major components. Maximum fuselage diameter 6 ft. (1.83 m.). Minimum ground clearance 2 ft. 0.25 in. (0.615 m.).

TAIL UNIT.—Cantilever monoplane tailplane with dihedral and single fin and rudder. All-metal structure. Variable incidence tailplane hinged at its leading-edge and operated by an English Electric actuator in the rear fuselage. Spring trim-tabs in port elevators. Mass-balanced rudder with spring trim-tabs. Tailplane span 27 ft. 4.9 in. (8.35 m.). Tailplane and elevator area 71.22 sq. ft. (6.62 m.²). Tailplane centre-line chord 10 ft. (3.05 m.). Tailplane tip-chord 4 ft. (1.22 m.). Tailplane dihedral 10 degrees. Fin and rudder root chord (less dorsal fin) 12 ft. 8.5 in. (3.9 m.). Fin and rudder tip chord 5 ft. 0.55 in. (1.54 m.).

LANDING GEAR.—Retractable nose-wheel type. Each main unit, of English Electric design, is an oleo-pneumatic shock-absorber strut



The English Electric Canberra P.R. Mk. 9 showing the increased span and centre-section chord.



The English Electric Canberra P.R. Mk. 9 (two Rolls-Royce Avon turbojet engines).

carrying a single wheel inboard on a cantilever stub axle. Dowty levered-suspension liquid-spring nose unit with twin wheels. Hydraulic retraction. Track 15 ft. 5 in. (4.7 m.).

Power Plant.—Two Rolls-Royce Avon axial-flow turbojet engines. Each engine carried in wing nacelle on four self-aligning mounting points, and completely accommodated forward of main spar, through which jet-pipe passes. Removable panels for installation of engine above and below nacelle, and servicing panel under forward end. Oil cooling radiator buried in wings outboard of nacelles. Flame detectors and a fire extinguishing system are fitted. Cartridge-fired turbine starter. Main fuel stowage in centre fuselage. Provision for auxiliary wing-tip tanks.

Accommodation (B. Mk. 2).—Crew of three, comprising pilot, navigator/plotter and observer, all provided with ejector seats. Pilot seated off-centre to port under large double-layer Perspex canopy, navigator further aft to starboard and observer behind pilot. Large crew escape hatch aft of canopy with two roof-lights. Transparent nose fairing with a visual sighting panel for the bomb-aimer. Cabin pressurisation by air supply from engine compressors. System operates automatically above 10,000 ft. (3,050 m.) and pressurizes to a differential of 3.5 lb./sq. in. (0.248 kg./m.²). Emergency oxygen system. Crew entry through an upward-hingeing door in fuselage starboard side.

Dimensions.—
Span 63 ft. 11½ in. (19.5 m.).
Length 65 ft. 6 in. (20 m.).
Height over fin 15 ft. 7 in. (4.75 m.).

Weights and Performance.—
No data available.

FAIREY

THE FAIREY AVIATION CO., LTD.

Head Office: Hayes, Middlesex, London Office: 24, Bruton Street, W.1.

Works: Hayes, Middlesex; White Waltham, Near Maidenhead, Berks.; Stockport, Cheshire; Ringway Aerodrome, near Manchester; and Hamble, Hants.

Directors: G. W. Hall, A.F.R.Ae.S. (Chairman and Managing Director); R. Fairey (Vice-Chairman); W. Broadbent; L. M. Hilton, D.F.C., A.F.C., A.F.R.Ae.S.; C. H. Chichester Smith, D.S.C., A.F.R.Ae.S.; R. L. Lickley, B.Sc., D.I.C., M.I.Mech.E., F.R.Ae.S. (Technical Director and Chief Engineer); J. C. Macpherson, A.C.A.; A. Vines, A.F.R.Ae.S., A.M.I.P.E.

Deputy Chief Engineer and Chief Designer (Rotating Wing): Dr. G. S. Hislop.

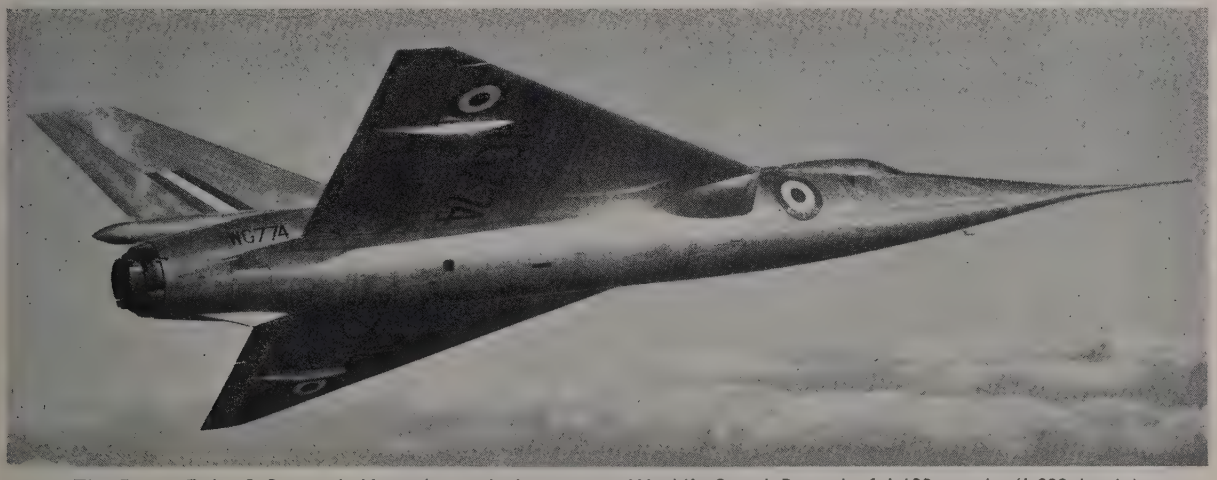
Chief Designer (Fixed Wing): D. Wakeford.

The Fairey Aviation Co., Ltd. has specialised on naval types for many years, although not to the exclusion of aircraft suitable for other purposes.

Many piston-engined Firefly aircraft, built between 1942 and 1956, remain in service, mainly for training duties and as pilotless drones. These have been described in detail in earlier editions of "All the World's Aircraft."

Production during 1957 was concentrated on the Gannet three-seat anti-submarine aircraft which is in service with the Royal Navy and the Royal Australian Navy and has been ordered by the West German Government. The Gannet trainer was in parallel production and reference has been made to the A.E.W. Mk. 3 early warning radar-equipped version which is under development to supersede the Navy's Skyraiders.

Flight research with the two Fairey Delta 2 research aircraft continued during 1957. It was announced that the company has produced design studies of advanced military aircraft based on the Delta 2, the first prototype of which set up a World's Speed Record of 1,132 m.p.h. (1,822 km.h.) on March 10, 1956. The second prototype exceeded Mach 1 during its first flight on February 15, 1956.



The Fairey Delta 2 Research Monoplane which set up a World's Speed Record of 1,132 m.p.h. (1,822 km.h.) on March 10, 1956.



The Fairey Delta 2 Research Monoplane (Rolls-Royce Avon turbojet engine with afterburner).

Development of the Ultra-Light helicopter has continued on a private venture basis. The company also completed during 1957 the first of two prototypes of its large Rotodyne helicopter.

To speed development of the Rotodyne, many of its rotor components were flight tested on the small Jet Gyrodyne research helicopter.

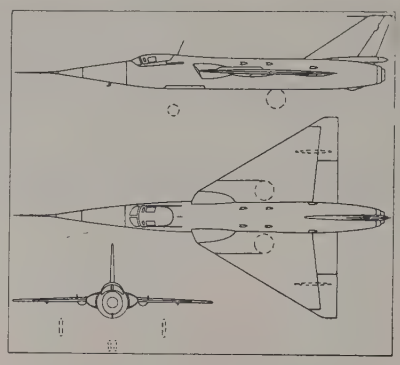
The Company's Weapon Division holds important development and production contracts. Details of its first operational missile, the Fireflash air-to-air guided weapon, were released in 1956 and are to be found in the "Guided Missiles" section of this work.

Other activities of the Fairey Company include the production of power control systems, which are used on the Hawker Hunter, Blackburn Beverley, Avro CF-100 and other types. The activities of its various subsidiary companies include air survey and air photography, the development and manufacture of plastics, and the design and manufacture of light marine craft.

THE FAIREY DELTA 2.

Two prototypes of the Fairey Delta 2 research aircraft have been built, under a Ministry of Supply contract, to investigate the characteristics of flight and control at transonic and supersonic speed in level flight.

The Delta 2 is a single-seat mid-wing delta design of all-metal construction and is powered by a Rolls-Royce Avon engine. The wing is of exceptionally thin section; nevertheless the main wheels of the tricycle landing gear retract fully into the wing. The whole of the nose section of the fuselage can be, and is, lowered in flight by the pilot to provide him with a good forward view for take-off, landing and taxying. In normal flight the movable nose is aligned to the datum line of the aircraft.



The Fairey Delta 2.

The first prototype of the Delta 2 flew on October 7, 1954, and set up a World's Speed Record of 1,132 m.p.h. (1,822 km.h.) on March 10, 1956. The second prototype made its first flight on February 15, 1956.

At the time of writing no other details were available for publication.

DIMENSIONS.—
Span 26 ft. 10 in. (8.18 m.).
Length 52 ft. 3 in. (15.94 m.).

THE FAIREY GANNET.

The Gannet is a three-seat anti-submarine aircraft which is in service with the Royal Navy and the Royal Australian Navy. Fifteen of the A.S. Mk. 4 version and one T. Mk. 2 have also been ordered for the German naval forces.

The power-plant of the Gannet is an Armstrong Siddeley Double Mamba which consists basically of two Mamba turboprop engines placed side-by-side, each driving one of two co-axial contra-rotating airscrews. For long-range cruising one or other of the engines and its airscrew can be stopped and feathered, the full power of both engines being used mainly for take-off and for combat.

Five versions of the Gannet have so far been announced. These are :—

Gannet A.S. Mk. 1. Three-seat anti-submarine aircraft. Pilot in first cockpit, observer/navigator in second cockpit and radio/radar operator in third cockpit. Retractable radome beneath rear fuselage.

Gannet T. Mk. 2. Operational training version of Mk. 1. Duplicated controls in first and second cockpits, with instructor in second. Main function is to provide advanced training in weapon and engine handling, but also to be adaptable for communications. Third cockpit can carry either radio operator or two passengers. No radome.

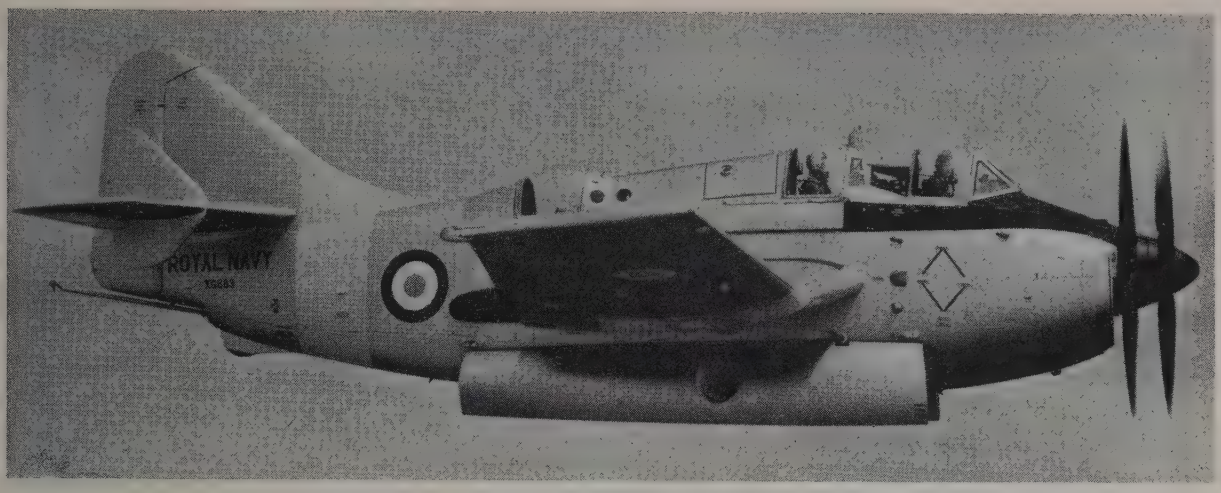
Gannet A.E.W. Mk. 3. This version of the Gannet will replace the Royal Navy's Skyraider early-warning aircraft. New features include deletion of the two rear cockpits, addition of a large under-fuselage radar scanner with accommodation inside the fuselage for the radar observers, a square-topped fin and rudder and new engine nozzles exhausting on each side of the fuselage under the wing leading edges.

Gannet A.S. Mk. 4. Similar to Mk. 1 but with more powerful Double Mamba power-plant. In production.

Gannet T. Mk. 5. Operational trainer. Similar to T. Mk. 2, but with more powerful Double Mamba power-plant as Mk 4. In production. First flew March 1, 1957.



The Fairey Gannet A.S. Mk. 4 (3,035 e.h.p. Armstrong Siddeley Double Mamba turboprop engine).



The Fairey Gannet T. Mk. 5 Trainer (3,035 e.h.p. Armstrong Siddeley Double Mamba turboprop engine).

TYPE.—Three-seat Anti-submarine and Training monoplane.
WINGS.—Mid-wing monoplane. All-metal structure. Wings fold mechanically, the inner sections folding up and outer sections folding down simultaneously. Large auxiliary aerofoil type flaps.
FUSELAGE.—All-metal monocoque structure.
TAIL UNIT.—Cantilever monoplane type, with two small auxiliary fins attached to leading edges of tailplane.
LANDING GEAR.—Retractable tricycle type. Fairey oleo-pneumatic shock-absorbers. Hydraulic retraction. Tail sting-type arrester hook. Catapult hooks under forward fuselage.
POWER PLANT.—One Armstrong Siddeley Double Mamba coupled turboprop, driving Rotol co-axial contra-rotating fully-feathering airscrews.
ACCOMMODATION.—Crew of three in tandem in individual cockpits with rearward-sliding canopies. Dual controls fitted in centre cockpit of T. Mk. 2 and T. Mk. 5.
ARMAMENT.—Torpedoes, bombs, depth charges, sono-buoys, etc. in internal bomb-bay. Rockets, sono-buoys, etc. under wings.
DIMENSIONS.—
Span 54 ft. 4 in. (16.56 m.).
Width (wings folded) 19 ft. 6 in. (5.94 m.).
Length 43 ft. (13.11 m.).
Height 13 ft. 8½ in. (4.18 m.).
Height (wings folded) 13 ft. 9 in. (4.19 m.).
WEIGHTS AND PERFORMANCE.—
No data available for publication.

THE FAIREY ULTRA LIGHT HELICOPTER.

The Fairey Ultra Light Helicopter, which flew for the first time on August 14, 1955, was intended primarily for Army observation and liaison duties.

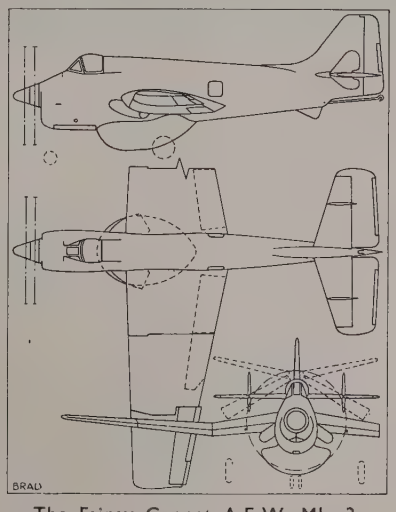
Ministry of Supply support was withdrawn as an economy measure in 1956, but development is being continued on a private venture basis. Variants of the basic type will be offered with the high performance characteristics of the prototypes, but with much improved payload-range.

The cabin, from which there is an excellent all-round view, seats two side-by-side.

A Blackburn Palouste turbo-compressor supplies compressed air to pressure-jet units at the tips of the two-bladed rotor. Directional control is achieved with a stainless steel rudder located in the engine exhaust.

The Ultra-Light can be transported on a 3-ton truck, and is suitable for all light helicopter duties, including crop spraying, the carriage of stretchers and for transporting quite heavy loads slung externally.

The developed version will offer good performance in both standard and tropical conditions, with an extremely high vertical rate of climb. It will be most efficient for operations requiring an endurance of one hour, although maximum endurance will be much greater than this.



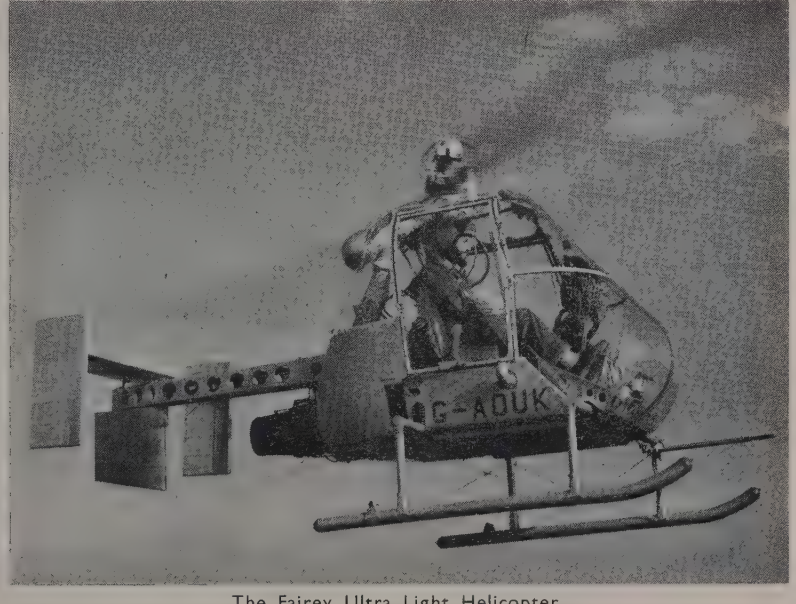
The Fairey Gannet A.E.W. Mk. 3.

TYPE.—Two-seat Light helicopter.
ROTOR SYSTEM.—Two-blade "see-saw" rotor of all-metal construction.
ROTOR DRIVE.—Pressure-jet units of Fairey design built into rotor tips.
FUSELAGE.—All-metal structure, built around central box containing fuel tank.
TAIL UNIT.—Cantilever monoplane type, with two fixed end-plate fins and movable central rudder of all-metal construction. Carried on detachable box-section metal tail-boom.
LANDING GEAR.—Tubular steel skids.
POWER PLANT.—One Blackburn-Turbomeca Palouste 500 air generator which supplies compressed air to rotor tip-mounted pressure-jet units of Fairey design.
ACCOMMODATION.—Enclosed cabin for pilot and passenger side-by-side.
DIMENSIONS.—
Rotor diameter 28 ft. 3½ in. (8.62 m.).
Length of fuselage 14 ft. 1 in. (4.30 m.).
Width of fuselage 6 ft. 6½ in. (2.00 m.).
Height 8 ft. 2 in. (2.49 m.).
WEIGHTS (developed version).—
Max. payload 640 lb. (290 kg.).
Weight loaded 1,800 lb. (817 kg.).
PERFORMANCE.—
Cruising speed 98 m.p.h. (158 km.h.).
Vertical rate of climb at S/L. 950 ft./min. (290 m./min.).
Max. range 184 miles (297 km.).
Max. endurance 2½ hours.

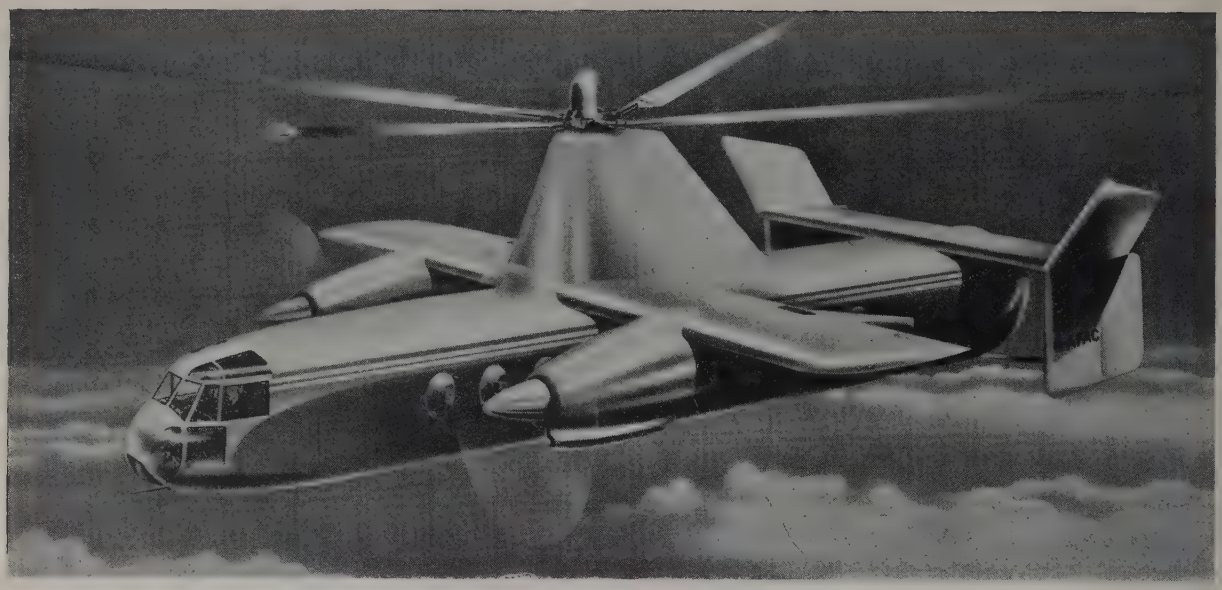
THE FAIREY ROTODYNE.

The Rotodyne, two prototypes of which have been ordered by the Ministry of Supply, is a commercial vehicle capable of carrying 40-48 passengers or approx. 15,000 lb. (6,800 kg.) of freight at a cruising speed of 184 m.p.h. (297 km.h.).

The prototypes each have a loaded weight of 33,000 lb. (14,970 kg.) and are powered by two Napier Eland N.El.3 turboprop engines of 3,000 e.h.p. Production aircraft will be powered by Eland N.El.7 engines of 3,500 e.h.p. Each



The Fairey Ultra Light Helicopter.



An artist's impression of the Fairey Rotodyne (two 3,000 e.h.p. Napier Eland turboprop engines).

engine drives an airscrew in constant mesh and also an auxiliary air compressor through a hydraulic clutch. The air compressors supply air through a ducting system to pressure-jet units mounted at the rotor tips. In these units fuel is injected and burned to give high thrust.

Considerable research into noise reduction has led to the development of suppressors which offer a 90 per cent. reduction at a distance of 200 ft. (60 m.) for a loss of only 5 per cent. thrust. The noise level of production aircraft at this distance will be 95 decibels, which is no greater than for large twin-engined helicopters with piston-engines.

The Rotodyne may be flown as a pure helicopter, with tip jets alight and airscrews giving zero thrust, or as an autogyro with engine power going into the airscrews only, the rotor being in autorotation. Tip-jet powered flight is used for take-off and landing, intermediate cruise flight is carried out as an autogyro. A feature of the design is that adequate single-engine performance is provided following an engine failure at any speed.

The Rotodyne has an unrestricted cabin space of 3,300 cub. ft. (93.45 m.³) permitting great flexibility of employment. Rear clam-shell doors give unobstructed entry for large loads including motor vehicles and a forward door permits simultaneous entry and exit of passengers for quick turn-around time.

The data below refers to the production version, but is generally applicable to the prototypes.

TYPE.—Large Transport helicopter.

ROTOR SYSTEM.—Single four-blade main rotor of all-metal (mainly stainless steel) two-spar construction. Swashplate-type of control mechanism. Area of each main rotor blade 79 sq. ft. (7.34 m.²). Total disc area 6,350 sq. ft. (590 m.²). No anti-torque rotor.

ROTOR DRIVE.—Tip-mounted pressure-jet units of Fairey design.

FIXED WINGS.—Conventional all-metal structure.

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Braced monoplane type with twin fins and rudders. All-metal structure.

LANDING GEAR.—Retractable tricycle type. Fairey oleo-pneumatic shock absorbers. Dunlop or Goodyear wheels. Wheel track 24 ft. 6 in. (7.47 m.). Wheelbase 23 ft. 9 in. (7.24 m.).

POWER PLANT.—Two 3,500 e.h.p. Napier Eland N.El.7 turboprop engines mounted under fixed wings in conventional manner. Fuel in wing tanks with total capacity of 7,500 lb. (3,400 kg.).

ACCOMMODATION.—Pilot and co-pilot side-by-side in nose, with dual controls. Cabin with 3,300 cub. ft. (93.45 m.³) unrestricted space for 40-48 passengers or 15,000 lb. (6,800 kg.) freight.

DIMENSIONS.—
Main rotor diameter 90 ft. (27.4 m.).
Length of fuselage 58 ft. 8 in. (17.88 m.).
Span of fixed wings 46 ft. 6 in. (14.17 m.).
Height to top of rotor pylon 22 ft. 2 in. (6.75 m.).

WEIGHT (Eland N.El.3 engines).—
Weight loaded 33,000 lb. (14,970 kg.).

PERFORMANCE (Estimated—N.El.7 engines).—
Cruising speed 184 m.p.h. (297 km.h.).
Vertical rate of climb at S/L. 1,800 ft./min. (550 m./min.).
Stage length with 48 passengers and full reserves 230 miles (370 km.).

FOLLAND

FOLLAND AIRCRAFT LTD.

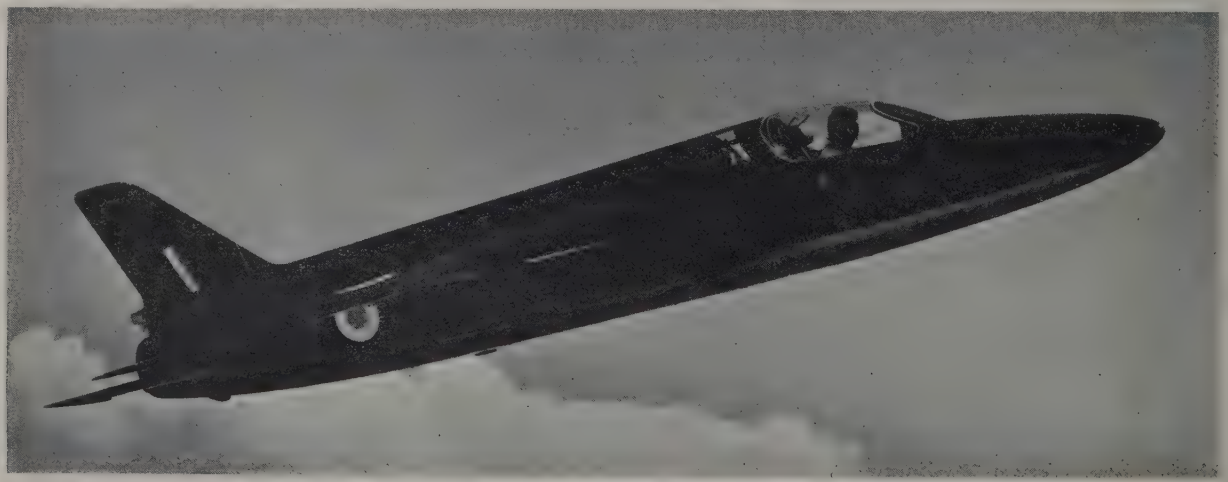
HEAD OFFICE AND WORKS: HAMBLE, SOUTHAMPTON, HAMPSHIRE.

Chairman: C. L. Hill.

Directors: W. E. W. Petter, C.B.E., B.A., F.R.Ae.S. (Managing, and Chief Engineer), E. N. Egan, F.C.W.A. (Assistant Managing), E. C. Lysaght, Sir Raymond Quilter, Bt., C. E. Blunt.

This company was originally formed as British Marine Aircraft, Ltd., in August, 1935. This became a public company in February, 1936 and the change of name was made in December, 1937. The main factory is at Hamble and there are branch works at Eastleigh Airport, Chilbolton and elsewhere in the Southampton district.

Since the war, the company has been largely occupied with sub-contract work, which has included the production of wings for the de Havilland Vampire, Venom and Sea Venom and, more recently, tailplanes for the Hawker Hunter fighter, engine cowlings for the Bristol Britannia



The Folland Gnat Mk. I Lightweight Fighter (Bristol Orpheus turbojet engine).



The Folland Gnat Mk. 1 Lightweight Fighter (Bristol Orpheus turbojet engine).

airliner and centre-section components for the de Havilland Sea Vixen. Another activity has been the development of a lightweight ejection seat from a basic design by the Swedish SAAB company.

In 1951, Folland started work on the design of a private-venture light fighter, the Gnat, under the direction of Mr. W. E. W. Petter, the company's Managing Director.

At first the company had the encouragement of the Air Ministry, but this lapsed when the development of the original engine around which the Gnat had been designed was abandoned. The company however, decided to alter the design sufficiently to take the lower-powered Armstrong Siddeley "long life" Viper engine in order to gain flight experience. To avoid confusion the Viper-powered prototype was named the Midge.

The Midge flew for the first time on August 11, 1954, and underwent extensive flight testing, during which it was dived at supersonic speed despite the low power (1,640 lb.=745 kg. s.t.) of its engine.

Meanwhile, in November, 1953, the Bristol Aeroplane Company had announced its intention to design and build the Orpheus engine and, following this, work on the Gnat was resumed.

The first Gnat prototype made its maiden flight on July 18, 1955, and the second (the first of a batch of six for the Ministry of Supply) made its first flight on May 26, 1956.

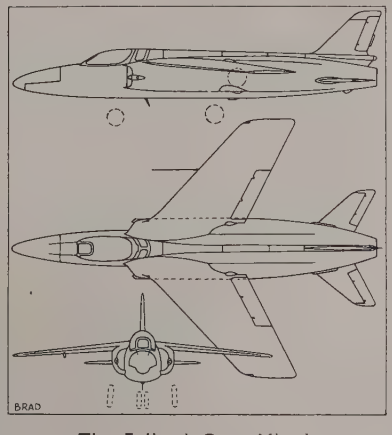
So far, orders have been received for 71 Gnats for the Ministry of Supply and the Indian and Finnish Governments. The aircraft will also be built under licence in India by Hindustan Aircraft Ltd. and in Finland by Valmet Oy.

THE FOLLAND Fo. 141 GNAT.

The following versions of the Gnat have been announced :—

Gnat Mk. 1. Standard single-seat fighter version. Bristol Orpheus 701 (BOr.2) turbojet (4,520 lb.=2,050 kg. s.t.). Fifty-seven for Ministry of Supply, India and Finland.

Gnat Trainer. Tandem two-seat development of Mk. 1. Bristol Orpheus BOr.4 turbojet (4,230 lb.=1,919 kg. s.t). Fuselage lengthened by 9 in. (0.23 m.). Fuel tank between air intakes deleted. Both occupants on Folland/Saab lightweight ejection seats under one-piece jettisonable canopy. Rear seat raised for improved forward view. Duplicated instruments, radio and controls. Wing of increased area and 7% thickness/chord ratio, with outboard ailerons and split



The Folland Gnat Mk. 1.

flaps. No armament. Additional fuel tanks in gun bays, giving duration of 75 min. at height. This can be increased to 135 min. by use of underwing tanks. Fourteen ordered for evaluation by R.A.F. as transonic trainers. First scheduled to fly in 1959.

DIMENSIONS.—
Span 24 ft. (7.32 m.).
Length 30 ft. 9 in. (9.37 m.).
Height 9 ft. 3 in. (2.82 m.).

Gnat 2. Prototype under development as private venture. Basically similar to Gnat Mk. 1, but with 6% t/c. wing and more powerful Orpheus turbojet, giving maximum speed of Mach 1.25. Scheduled to fly in 1959.

Gnat 4. Projected development of Gnat 2 with A.I. search, radar and guided weapons.

The Gnat Mk. 1 lightweight fighter is approximately one-third the weight and half the size of a standard jet fighter. It is built without the use of large and costly machine tools and therefore shows also a substantial saving in cost.

Despite its small size, the Gnat Mk. 1 has a high subsonic speed in level flight, an exceptionally good rate of climb and small turning radius.

The following specification applies specifically to the Gnat Mk. 1.

TYPE.—Single-seat lightweight Fighter or Fighter-Bomber.

WINGS.—Shoulder-wing cantilever swept-wing monoplane. Angle of sweepback 40°. Chord (mean) 6 ft. 2 in. (1.87 m.). Thickness/chord ratio 8%. Aspect ratio 3.575. Anhedral 5°. One-piece wing of multi-web thick-skin light alloy construction fits in recess in top of fuselage and secured by bolts at four main points. Power-operated large-area inboard ailerons. Ailerons droop to serve as flaps. Gross wing area 136.6 sq. ft. (12.69 m.²).

FUSELAGE.—Light alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Hydraulically-operated one-piece tailplane. Vertical area 14 sq. ft. (1.30 m.²). Horizontal area 18 sq. ft. (1.66 m.²). Span of tail 9 ft. (2.74 m.).

LANDING GEAR.—Retractable nose-wheel type, all wheels retracting into fuselage. Messier shock-absorber struts. Wheel well fairings attached to individual landing-gear units and serve as air-brakes when landing-gear is partly lowered, the relative movements of the air brakes being so adjusted that no change of trim occurs at any speed. A stop on landing-gear air brake selector prevents gear from being fully lowered when braking is desired. Toe-operated Dunlop disc wheel brakes. Main wheel tyres 20×5.25, nose-wheel tyres (twin) 17×3.25. Wheelbase 7 ft. 9 in. (2.36 m.). Track 5 ft. 1 in. (1.55 m.).

POWER PLANT.—One Bristol Orpheus 701 (BOr.2) axial-flow turbojet engine 4,520 lb. = 2,050 kg. s.t. Air intakes in sides of fuselage. All fuel in fuselage with common collector tank and one booster pump. To provide extra range two under-wing jettisonable tanks can be fitted. Compressed-air starting, air bottles being filled by two-stage petrol engine-driven compressor on ground rig.

ACCOMMODATION.—Single-seat pressurised cockpit with jettisonable canopy. Folland-Saab lightweight automatic ejector seat. Standard cockpit instrumentation.

ARMAMENT.—Two 30 mm. Aden cannon in the air intake fairings, one on each side of fuselage. Provision for underwing mounting of two 500-lb. (227 kg.) bombs or twelve 3-inch (7.6 cm.) rocket projectiles, etc.

EQUIPMENT.—VHF radio and standby set and navigation aid, gyro gun-sight and radar ranging, supplementary oxygen supply, braking parachute, etc.

DIMENSIONS.—
Span 22 ft. 2 in. (6.75 m.).
Length 29 ft. 9 in. (9.06 m.).
Height 8 ft. 9 in. (2.66 m.).

WEIGHTS.—
Interceptor version: loaded weight 6,200 lb. (2,810 kg.).
Tactical version: max. loaded weight with external tanks and armament 8,500 lb. (3,845 kg.).

PERFORMANCE.
Max. speed Mach 0.98.
Climb to 45,000 ft. (13,700 m.) 5 min.
Ceiling over 50,000 ft. (15,000 m.).
Take-off distance to clear 50 ft. (15.25 m.) (interceptor) 1,950 ft. (595 m.).
Take-off distance to clear 50 ft. (15.25 m.) (tactical) 3,300 ft. (1,020 m.).
Landing distance from 50 ft. (15.25 m.) 3,300 ft. (1,020 m.).
Radius of action 460 miles (750 km.).
Normal endurance 1 hr.
Endurance with under-wing tanks 2 hr.

GLOSTER



The Gloster Javelin F. (AW) Mk. 2 two-seat All-weather Fighter (two Armstrong Siddeley Sapphire turbojet engines).

GLOSTER AIRCRAFT CO. LTD.

HEAD OFFICE, WORKS AND AERODROME: GLOUCESTER.

Directors: Sir Frank Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman); Sir Thomas Sopwith, C.B.E., F.R.Ae.S.; H. Burroughes, F.R.Ae.S.; R. V. Atkinson (Works Director); R. W. Walker, F.R.Ae.S. (Director and Chief Designer) and E. W. Shambrook, F.C.I.S. (Secretary).

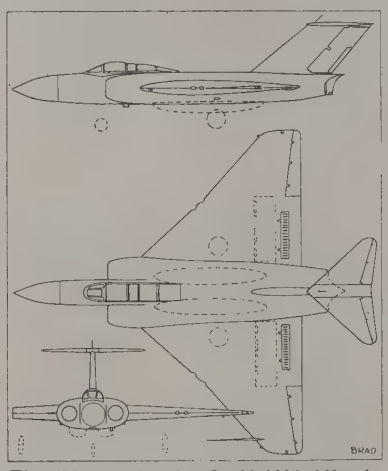
The Gloster Aircraft Co., Ltd., which now forms part of the Hawker Siddeley Group, was formed in 1915 and since then has specialised mainly in the production of high-performance military aircraft.

To the Gloster company belongs the distinction of being the first aircraft manufacturer in either Great Britain or the United States to design, build and fly an aircraft propelled by a gas-turbine jet engine. From the experience gained in the design, construction and flight testing of the two E.28/39 prototypes, the first of which flew on May 15, 1941, the Gloster company designed and put into production the Meteor single-seat twin-jet fighter.

The Meteor, in various marks, has been in service in the R.A.F. since 1943. It has also been supplied to many foreign air forces, including those of the Argentine Republic, Australia, Belgium, Brazil, Denmark, Egypt, France, Holland, Israel and Syria. The Meteor was phased out of production by Gloster in 1954 and the last R.A.F. squadron equipped with the Mk. 8 single-seat fighter version was re-equipped with Hunters in the Spring of 1957.

A number of Meteor T. Mk. 7 trainers remain in service with the R.A.F. and Fleet Air Arm, together with photo-reconnaissance and two-seat night fighter variants. These aircraft have been fully described in earlier editions of "All the World's Aircraft."

In June, 1952, the Javelin two-seat twin-engined delta-wing all-weather fighter was ordered into production for the Royal Air Force.



The Gloster Javelin F. (A.W.) Mk. 4.

Over and above its normal production commitments, the Company is engaged in a very extensive development and research programme. Its Technical Developments Division, formed in 1956, was established to make available to general industry various examples of aeronautical technology.

THE GLOSTER G.A.5 JAVELIN.

The Javelin was the first twin-engined delta-wing aircraft and the first in Britain to be designed for a specific operational rôle—that of an All-weather Fighter. Five prototypes were built, the first flying for the first time on November 26, 1951. The first production Javelin F. (AW) Mk. 1 flew on July 22, 1954, and this type entered service with R.A.F. Fighter Command in 1956.

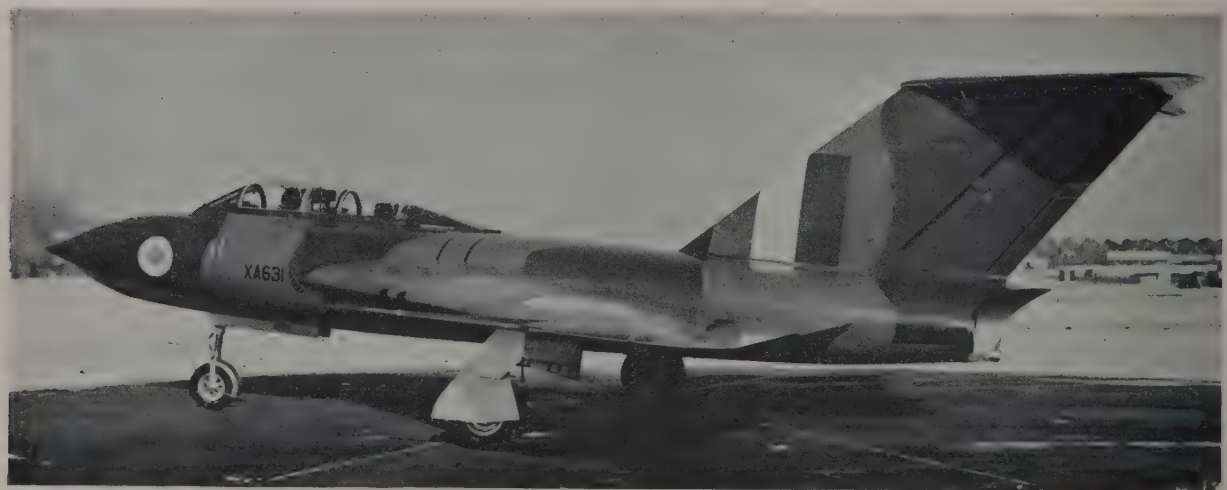
The following versions of the Javelin have been announced:—

Javelin F. (AW) Mk. 1. Initial production version, with Sapphire ASSa.6 engines (8,300 lb. = 3,770 kg. s.t.).

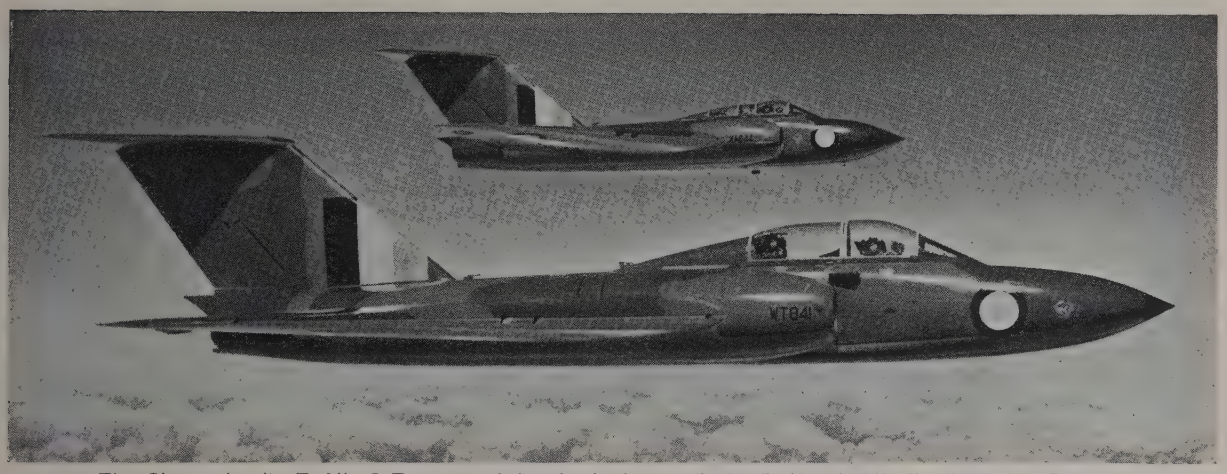
Javelin F. (AW) Mk. 2. Similar to Mk. 1, but with equipment changes. Prototype flew October 31, 1955, and first production model April 25, 1956.

Javelin T. Mk. 3. Dual-control trainer. Prototype, built by Air Service Training Ltd., flew August 20, 1956. Fuselage lengthened to 61 ft. 0 in. (18.59 m.). No nose radar. "All flying" tail. Martin-Baker ejection seats.

Javelin F. (AW) Mk. 4. Similar to Mk. 1, but with "all flying" tail. Prototype flew September 19, 1955, and first production model February 27, 1956.



The Gloster Javelin F. (A.W.) Mk. 4 two-seat All-weather Fighter (two Armstrong Siddeley Sapphire turbojet engines).



The Gloster Javelin T. Mk. 3 Trainer and (in the background) the F. (A.W). Mk. 7 All-weather Fighter.

Javelin F. (AW) Mk. 5. New wing with increased internal fuel capacity. Two belly tanks each 126 Imp. gallons (573 litres) instead of 250 Imp. gallons (1,136 litres). Prototype flew July 26, 1956, and first production model August 24, 1956.

Javelin F. (AW) Mk. 6. Similar to Mk. 5, but with equipment changes. Prototype flew December 14, 1956, and first production model January 15, 1957.

Javelin F. (AW) Mk. 7. Similar to Mk. 4, but with up-rated engines. Prototype flew April 27, 1956 and first production model November 9, 1956.

Javelin F. (AW) Mk. 8. Similar to Mk. 7 but with equipment changes.

The only details of the Javelin which were available for publication at the time of going to press follow.

TYPE.—Two-seat All-weather Fighter.

WINGS.—Mid-wing monoplane of Delta configuration. Wing section RAE. 101. Sweepback at 25% of chord 39.5° on inner wing, 33.8° on outer wing. All-metal stressed-skin structure. Power-boosted all-metal ailerons. Hydraulically-operated all-metal slotted flaps and air-brakes.

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—All surfaces swept-back. Sweepback at 25% of chord, 47.6° on fin, 42.8° on tailplane. Variable-incidence delta tailplane at top of fin on Mks. 1 and 2. "All flying" tail on later Mks. All-metal stressed-skin structure. Tailplane span 17 ft. (5.18 m.).

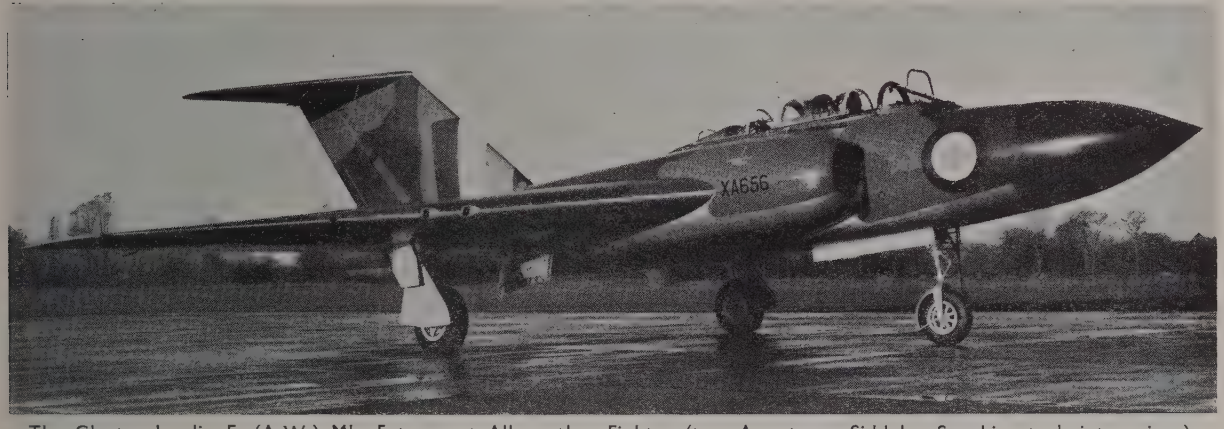
LANDING GEAR.—Retractable nose-wheel type. Hydraulic actuation. Dowty liquid-spring shock-absorbers. Dunlop wheels. Lockheed hydraulic disc brakes with Maxaret control. Track: 23 ft. 4 in. (7.11 m.).

POWER PLANT.—Two Armstrong Siddeley Sapphire turbojet engines in nacelles on sides of fuselage.

ACCOMMODATION.—Crew of two, pilot and radar-operator, in tandem in pressurised cockpit. Martin-Baker ejection seats. Full air-conditioning.

ARMAMENT.—Four 30 mm. Aden guns mounted two in each wing. Provision for four de Havilland Firestreak air-to-air guided weapons on under-wing pylons.

DIMENSIONS.—
Span 52 ft. (15.86 m.).
Length 56 ft. 4 in. (17.18 m.).
Height (over tail, static position) 16 ft. (4.88 m.).



The Gloster Javelin F. (A.W.) Mk. 5 two-seat All-weather Fighter (two Armstrong Siddeley Sapphire turbojet engines).

HANDLEY PAGE

HANDLEY PAGE, LTD.

HEAD OFFICE AND WORKS: CRICKLEWOOD, LONDON, N.W.2.

AERODROME: COLNEY STREET, RADLETT, HERTFORDSHIRE.

HANDLEY PAGE (READING) LTD.

REGISTERED OFFICE: CRICKLEWOOD, LONDON, N.W.2.

WORKS: WOODLEY, NEAR READING, BERKS.

Directors: Sir Frederick Handley Page, C.B.E. (Chairman and Managing Director), Air Cdre. A. Vere Harvey, C.B.E., M.P. (Deputy Chairman), G. C. D. Russell, A.F.R.Ae.S. (Assistant Managing Director), A. A. Lough, F.C.A., Sir Thomas Stuart Overy.

Director, Technical Department: R. S. Stafford, C.B.E., F.R.Ae.S.

Chief Designer (Handley Page, Ltd.): C. F. Joy, F.R.Ae.S.

Chief Designer (Handley Page (Reading) Ltd.): J. Allan, Dip.Ae. (Hull), A.F.R.Ae.S.

Secretary: J. H. S. Green, A.C.A.

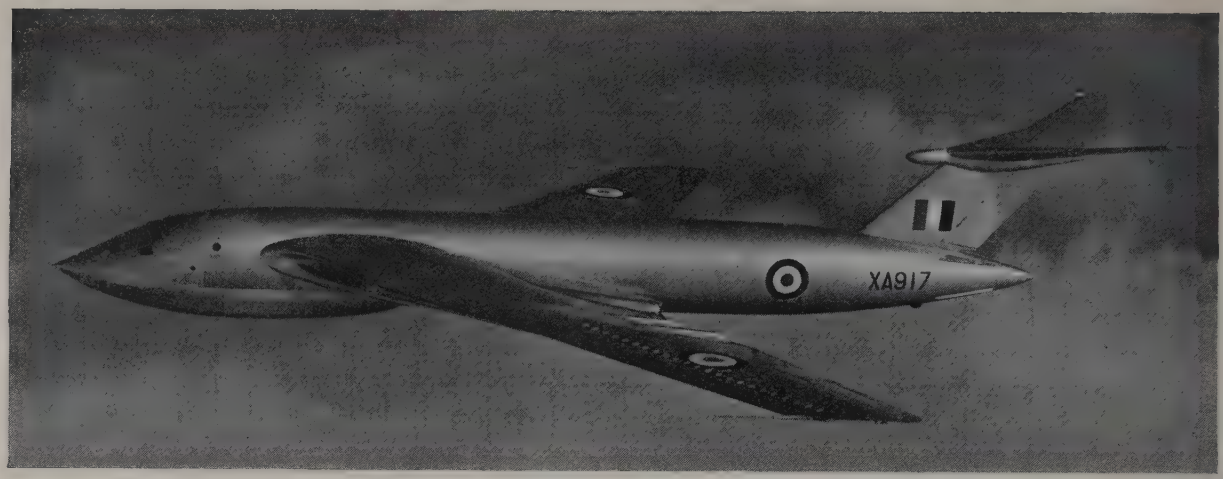
Handley Page, Ltd., has been associated with flying in all its aspects since June 17, 1909. It thus possesses the proud distinction of being the first limited company incorporated in Great Britain for the purpose of manufacturing aircraft.

The latest product of Handley Page, Ltd. is the "crescent-wing" Victor bomber, which is in production for the Royal Air Force.

A civil version of this aircraft, using the wings, tail-unit, flying controls, systems and services of the Victor, but with a new "double-bubble" fuselage accommodating up to 172 passengers, has been offered for service by 1961. Powered by four Rolls-Royce Conway turbojets, it would carry a payload of nearly 18 tons at a cruising speed of over 600 m.p.h. (966 km.h.) on medium-stage routes. At the time of going to press, no decision had been taken to progress beyond the initial design stage.

Since 1953, the company has been engaged on laminar flow research with a two-seat Vampire. A special "glove wing" test section, mounted on the upper surface of the aircraft's port wing, incorporates 39 spanwise suction-surface strips, through which a small amount of the boundary layer air is drawn into ducts beneath the wing surface. Suction is provided by a turbine-driven blower, powered by compressed-air tapped from the turbojet engine compressor. Flight tests have shown that skin-friction drag can be reduced by as much as 82% using this technique, and Handley Page have produced various projects for large civil airliners incorporating this form of boundary layer control.

Handley Page (Reading), Ltd. was formed in June, 1948, when Handley Page, Ltd. took over Miles Aircraft, Ltd. At the same time it acquired the production rights of the Miles Marathon feeder-line transport, which was put into production as the Handley Page Marathon.



The Handley Page Victor B. Mk. 1 Bomber (four Armstrong Siddeley Sapphire turbojet engines).

The latest Handley Page (Reading) design is the H.P.R.3 Herald, a medium-range civil transport which is now offered with either four Alvis Leonides Major piston-engines or two Rolls-Royce Dart turboprops.

THE HANDLEY PAGE H.P.80 VICTOR.

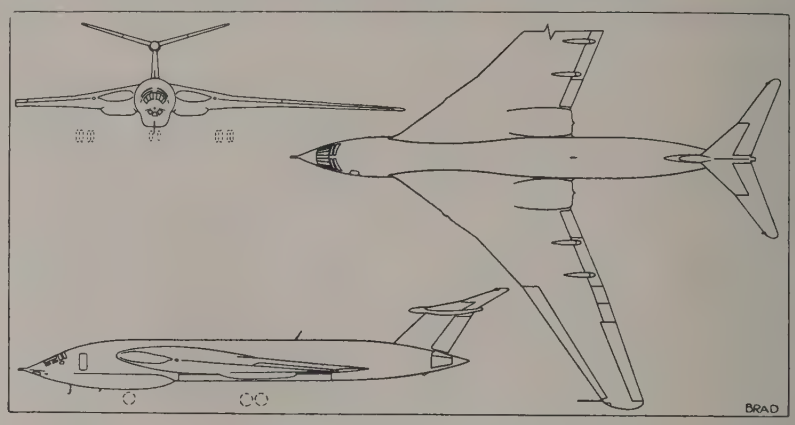
The Victor four-jet bomber employs the so-called "crescent wing" in which the angle of sweep of each wing is progressively decreased from root to tip, with the outer sections only slightly swept.

This configuration was evolved to meet the demands of a specification which called not only for operation at high sub-sonic speeds at altitude over very long ranges, but also good control over the whole speed range, particularly at the approach and landing.

At the time of writing security restrictions did not permit the publication of structural or performance details of the Victor, of which two versions have been announced :—

Victor B. Mk. 1. Initial production version with four Armstrong Siddeley Sapphire turbojets. First of two prototypes flew December 24, 1952. Production B. Mk. 1 aircraft, flight-tested in 1956, have slightly longer nose than prototypes, single-piece wing leading-edge flaps and no dorsal fin.

Victor B. Mk. 2. Developed version, ordered into production, with four Rolls-Royce Conway R.Co.11 turbojets.



The Handley Page Victor B. Mk. 1 Bomber.

In 1955 the Under Secretary of State for Air revealed that the Victor has flown to within a small fraction of the speed of sound at an altitude of over 50,000 ft. (15,250 m.), and in 1957 a production Victor exceeded the speed of sound in a dive.



The Handley Page Victor B. Mk. 1 Bomber (four Armstrong Siddeley Sapphire turbojet engines).



The Handley Page Leonides Herald (four 870 h.p. Alvis Leonides Major engines).

DIMENSIONS.—
Span 110 ft. (33.5 m.).
Length 114 ft. 11 in. (35.0 m.).
Height 28 ft. 1½ in. (8.60 m.).

THE HANDLEY PAGE H.P.R.3 HERALD.

The Herald, which originates from the Handley Page (Reading) design department, is a pressurised high-wing civil transport which has been designed to operate from primitive airfields under a wide range of climatic conditions.

Two versions are available as follows :—

Leonides Herald. Original version, powered by four Alvis Leonides Major piston-engines. First of two prototypes flew on August 25, 1955 and is being modified into Dart Herald. First production model scheduled to fly early in 1958.

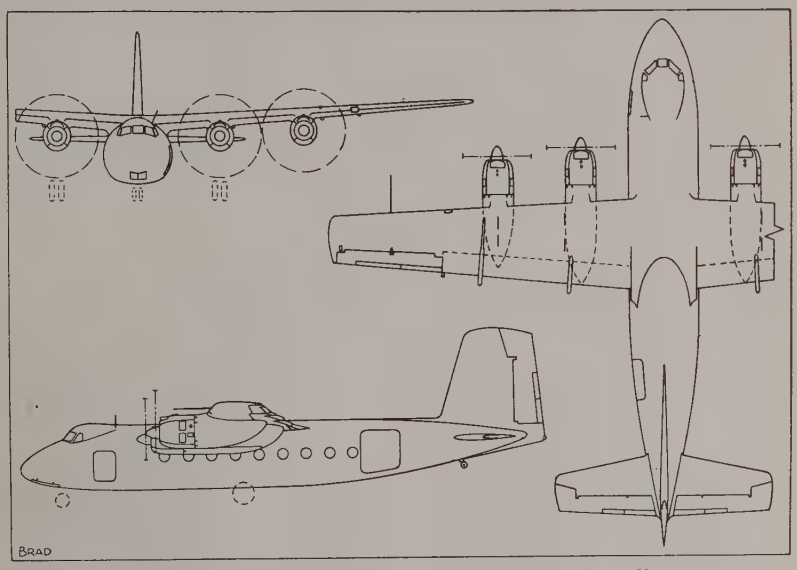
Dart Herald. Developed version, announced in May, 1957, with two Rolls-Royce Dart Mk. 527 turboprop engines. First flight scheduled for early 1958.

The two versions are generally similar except for power plant ; and the following structural details are applicable to both, except where stated otherwise.

TYPE.—Medium-range Feeder-line or General Purpose Transport.

WINGS.—High-wing cantilever monoplane. Dihedral 4°. Chord 12 ft. 0 in. (3.66 m.) at root, 6 ft. 3 in. (1.91 m.) at tip. Centre-section, which carries the engines, is of sandwich construction, having double skinning separated by metal corrugation and no conventional spar structures. Outer wings have two-spar all-metal stressed-skin structure. Slotted flaps inboard of ailerons. Thermal de-icing. Total area of ailerons 59.4 sq. ft. (5.52 m.²). Total area of flaps 162 sq. ft. (15.06 m.²). Gross wing area 886 sq. ft. (82.4 m.²).

FUSELAGE.—All-metal stressed-skin structure.

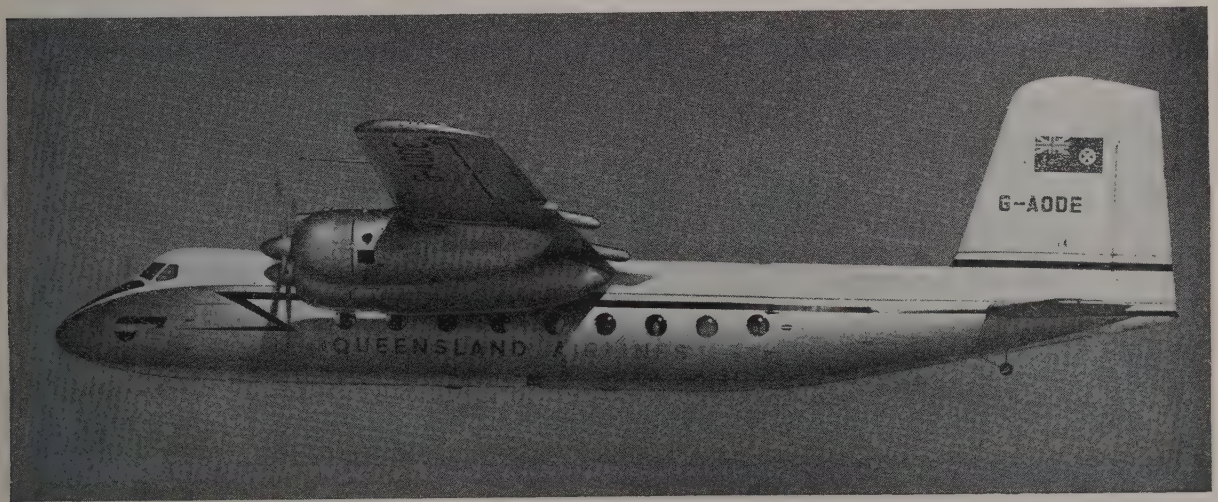


The Handley Page Leonides Herald "Branch-liner."

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. All-metal structure. Thermal de-icing. Areas : vertical surfaces 193 sq. ft. (17.93 m.²), tailplane 252 sq. ft. (23.41 m.²), elevators 71.13 sq. ft. (6.61 m.²). Span of tailplane 36 ft. 9½ in. (11.22 m.).

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Main units retract forward into engine nacelles. All units have twin wheels. Main wheels size 34 × 11.75-14. Nose-wheels size 23 × 7.25-10. Maximum tyre pressure 60 lb./sq. in. (4.218 kg./cm.²). Nose-wheels are steerable through an angle of 110° by hydraulics from the control column. They are also self-centring and fully-castoring. Hydraulic disc-type wheel brakes on main units. Wheelbase Leonides Herald, 24 ft. 2 in. (7.37 m.), Dart Herald 25 ft. 10 in. (7.87 m.). Track (between centre-lines of oleo legs) 22 ft. (6.71 m.).

POWER PLANT (Leonides Herald).—Four 870 h.p. Alvis Leonides Major fourteen-cylinder two-row radial air-cooled engines in nacelles/ underslung from the wing and



The Handley Page Leonides Herald (four 870 h.p. Alvis Leonides Major engines).

enclosed in four-section "petal" cowlings. Three-blade de Havilland constant-speed airscrews 11 ft. (3.35 m.) diameter. Two fuel tanks (350 Imp. gallons = 1,591 litres each) in wings, one on each side of fuselage with space for an additional 300 Imp. gallons (1,364 litres). Oil tank in each engine nacelle.

POWER PLANT (Dart Herald).—Two Rolls-Royce Dart Mk. 527 (R.Da.7) turboprop engines, each giving 1,910 s.h.p. plus 502 lb. (228 kg.) s.t. (= 2,105 e.h.p.) for take-off. Rotol four-blade fully-feathering constant-speed airscrews, diameter 12 ft. 6 in. (3.81 m.). One fuel tank of 350 Imp. gallons (1,591 litres) and one of 150 Imp. gallons (682 litres) in each wing. Total fuel capacity 1,000 Imp. gallons (4,546 litres). Oil capacity 6 Imp. gallons (27.3 litres).

ACCOMMODATION.—Flight compartment in nose for crew of two, with separate entry door. Duplicate flying controls and flight instruments. Main cabin may be arranged to seat up to 44 (Leonides Major version) or 43 (Dart version) passengers in forward or backward-facing seats in high-density versions. Standard seating for 36 passengers, with galley, etc. Entire accommodation pressurised with a maximum differential of 3.35 lb./sq. in. (0.235 kg./cm.²), equivalent to a cabin altitude of 6,300 ft. (1,922 m.) when flying at 15,000 ft. (4,570 m.). Passenger entry door at rear end of cabin on port side, with adjacent door giving access to standard baggage and freight compartment aft. Overall size of doorway 5 ft. 4 in. high, 5 ft. 5 in. wide (1.62 × 1.65 m.). A non-stressed removable bulkhead can be used to permit various combinations of passenger/freight loads, the various bulkhead stations being in the forward part of the cabin. All seats may be removed to convert entire cabin for freight carrying. Seat attachments serve as tie-down points. Passenger and freight loading door sills 3 ft. 6 in. (1.06 m.) from ground. Cabin is 43 ft. 8 in. (13.31 m.) long, 6 ft. 3 in. (1.9 m.) high and 8 ft. 6 in. (2.59 m.) wide. Cabin volume is 2,152 cub. ft. (60.90 m.³).

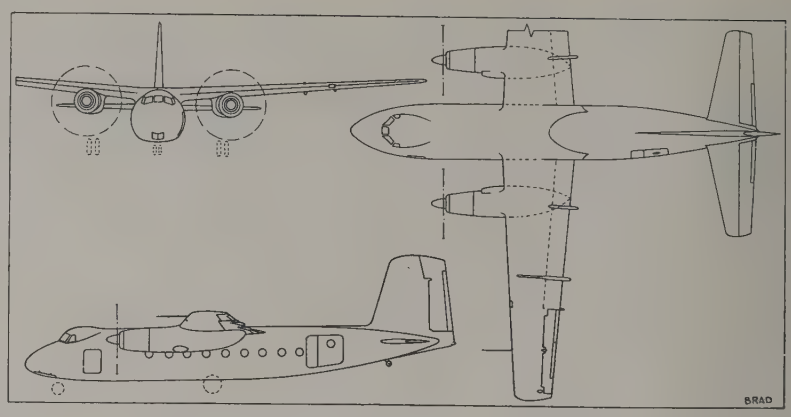
DIMENSIONS.—
Span 94 ft. 9½ in. (28.86 m.).
Length 71 ft. 11 in. (21.92 m.).
Height over tail 22 ft. 4 in. (6.80 m.).

WEIGHTS (Leonides Herald).—
Basic operational weight (36-seater) 25,241 lb. (11,459 kg.).
Max. T.O. and landing weight 37,500 lb. (17,024 kg.).

WEIGHTS (Dart Herald)—
Basic equipped weight (36-seater) 22,808 lb. (10,345 kg.).
Max. payload (36-seater) 10,160 lb. (4,608 kg.).
Max. take-off and landing weight 37,000 lb. (16,783 kg.).
Max. zero fuel weight (36-seater) 32,968 lb. (14,954 kg.).

PERFORMANCE (Leonides Herald).—
Speed at max. weak mixture power (at 36,000 lb. = 16,329 kg. A.U.W.) 224 m.p.h. (361 km.h.) at 13,350 ft. (4,070 m.).
Rate of climb at 10,000 ft. (3,050 m.) (at max. A.U.W.) 805 ft./min. (245 m./min.).
Time to 10,000 ft. (3,050 m.) 9.3 min.
Service ceiling 19,900 ft. (6,066 m.).
Take-off distance to clear 50 ft. (15.25 m.) 701 yds. (641 m.).
Landing distance from 50 ft. (15.25 m.) 749 yds. (685 m.).

RANGES (Leonides Herald).—
With max. payload (10,100 lb. = 4,585 kg.). (at 50% M.E.T.O.) 280 miles (450 km.).



The Handley Page Dart Herald "Branch-liner."

With full tanks and 6,395 lb. (2,903 kg.) payload (at 50% M.E.T.O.) 1,225 miles (1,972 km.).
With long-range tanks and 4,115 lb. (1,867 kg.) payload (at 50% M.E.T.O.) 1,815 miles (2,927 km.).

PERFORMANCE (Dart Herald).—
Speed at recommended cruise power (13,800 r.p.m.) at 36,000 lb. (16,329 kg.) A.U.W., I.S.A. conditions, at 15,000 ft. (4,575 m.) 275 m.p.h. (443 km.h.).
Rate of climb at 10,000 ft. (3,050 m.) at max. A.U.W. 1,030 ft./min. (314 m./min.).
Time to 10,000 ft. (3,050 m.) 6.7 min.
Service ceiling 29,500 ft. (9,000 m.).
Take-off distance to 50 ft. (15.25 m.) 725 yds. (663 m.).
Take-off distance to 50 ft. (15.25 m.), with one engine failing at critical safety speed 1,390 yds. (1,272 m.).
Landing distance from 50 ft. (15.25 m.) 730 yds. (668 m.).

RANGES (Dart Herald, at 275 m.p.h. = 443 km.h. at 15,000 ft. = 4,575 m.).—
With max. payload (10,160 lb. = 4,608 kg.) 703 miles (1,131 km.).
With full tanks and 6,200 lb. (2,812 kg.) payload 1,430 miles (2,300 km.).

THE HANDLEY PAGE HASTINGS.

The Hastings is a general purpose long-range transport which is in service in the Royal Air Force and the Royal New Zealand Air Force. Its rôles include those of freighter, paratroop transport, ambulance, troop-carrier, supply dropper, jeep carrier and glider tug.

The following are the production versions of the Hastings :—

Hastings C. Mk. 1. Four Bristol Hercules 101 engines. Initial production version. First production C. Mk. 1 flew on April 25, 1947. Tailplane mounted above centre-line of fuselage. Original total internal fuel capacity 2,560 Imp. gallons (11,650 litres). All Mk. 1's have now been modified to Mk. 2 standard, including provision for extra tankage, and are now known as C. Mk. 1A.

Hastings Met. Mk. 1. Specially equipped version of the C. Mk. 1 for long-range meteorological reconnaissance.

Hastings C. Mk. 2. Four Bristol Hercules 106 engines. Tailplane lowered to centre-line of fuselage and increased in area to 442 sq. ft. (41.1 m.²) ; spring-tabs fitted in elevators. Extra fuel tanks in outer wings increase total tankage to 3,172 Imp. gallons (14,420 litres). Crew rest station replaced by air quartermaster post. Max. payload increased to 20,311 lb. (9,221 kg.).

Hastings C. Mk. 3. Four Bristol Hercules 737 engines, with single-stage blowers. Basically similar to the C. Mk. 2 apart from engine change. Four supplied to the Royal New Zealand Air Force.

Hastings C. Mk. 4. V.I.P. version of C. Mk. 2. De luxe accommodation for four V.I.P.'s and staff. All seats face aft. Four delivered to R.A.F. Transport Command.

A full structural description of the Hastings has appeared in previous editions of "All the World's Aircraft."

DIMENSIONS.—
Span 113 ft. (34.46 m.).
Length 81 ft. 8 in. (24.9 m.).
Height 22 ft. 6 in. (6.86 m.).

WEIGHTS.—
Basic equipped weight (freighter) 48,427 lb. (21,986 kg.).
Max. payload 20,311 lb. (9,221 kg.).
Payload 10,000 lb. (4,585 kg.) for 3,000 mile (4,827 km.) range.
Max. take-off weight 80,000 lb. (36,320 kg.).
Max. landing weight 74,000 lb. (33,570 kg.).

PERFORMANCE.—
Max. speed 348 m.p.h. (560 km.h.) at 22,200 ft. (6,770 m.).
Max. weak mixture cruising speeds 291 m.p.h. (468 km.h.) at 15,200 ft. (4,630 m.) and 302 m.p.h. (486 km.h.) at 23,600 ft. (7,190 m.).
Rate of climb 890 ft./min. (272 m./min.).
Climb to 20,000 ft. (6,100 m.) 26 minutes.
Service ceiling 26,500 ft. (8,077 m.).
Range with max. payload 1,690 miles (2,720 km.).
Max. range 4,250 miles (6,850 km.).
Take-off distance to 50 ft. (15.2 m.) 1,586 yds. (1,450 m.).
Landing distance from 50 ft. (15.2 m.) 1,430 yds. (1,308 m.).



The Handley Page Hastings C. Mk. 2 Transport (four 1,675 h.p. Bristol Hercules 106 engines).



The Hawker Hunter F. Mk. 5 (Armstrong Siddeley Sapphire turbojet engine) with underwing tanks and rocket armament.

HAWKER AIRCRAFT, LTD.

REGISTERED OFFICE: CANBURY PARK ROAD, KINGSTON-ON-THAMES, SURREY.

WORKS AND AERODROMES: CANBURY PARK ROAD AND RICHMOND ROAD, KINGSTON-ON-THAMES; DUNSFOLD, SURREY; LANGLEY, BUCKS.

Chairman: Sir Frank Spencer Spriggs, K.B.E., Hon.F.R.Ae.S.

Directors: Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; A. N. Spriggs, O.B.E., M.I.P.E. (Managing Director); J. T. Lidbury, J.P. (General Manager); Sir Sydney Camm, C.B.E., F.R.Ae.S. (Chief Designer); E. H. Jefferson; J. D. Stranks, A.F.R.Ae.S. (Works Director).

Secretary: E. G. Rubython.

HAWKER AIRCRAFT (BLACKPOOL) LTD.

REGISTERED OFFICE: SOUTH SHORE, BLACKPOOL, LANCS.

WORKS AND AERODROME: SOUTH SHORE, BLACKPOOL, LANCS.

Chairman: Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S.

Directors: Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S.; A. N. Spriggs, O.B.E., M.I.P.E. (Managing Director); E. H. Jefferson; Sir Sydney Camm, C.B.E., F.R.Ae.S. (Chief Designer); J. T. Lidbury, J.P. (General Manager).

Secretary: A. J. Laurence, A.S.A.A.

Hawker Aircraft, Ltd., was incorporated in 1933 as successor to the H. G. Hawker Engineering Co., Ltd., which was formed in 1920 as the outcome of the voluntary liquidation of the famous Sopwith concern.

The Hawker company produced during the last war a distinguished line of single-seat fighters, of which the Hurricane, the Typhoon, and the Tempest were the best known. From the Tempest was developed the Fury and Sea Fury, both of which were produced in numbers after the war.

The latest Hawker fighter is the Hunter which is in production for the Royal Air Force, is being built under licence in Holland (156) and Belgium (192) and has been supplied to Denmark (30), Iraq (5), Peru (16) and Sweden (120) from British production. The current R.A.F. production versions are the F. Mk. 6 and the T. Mk. 7. The latter version has also been ordered by the Dutch Ministry of War,

On August 31, 1957 it was announced that India has ordered "between 100 and 200 Hunters," including both the Mk. 6 and Mk. 7 versions.

The Hawker company is undertaking the development, as a private venture, of a supersonic strike fighter under the designation of P.1121.

The development and production of the Sea Hawk is now the responsibility of Sir W. G. Armstrong Whitworth Aircraft, Ltd., a sister company in the Hawker-Siddeley Group.

THE HAWKER P.1121.

A new single-seat supersonic strike aircraft is being developed by the Hawker company as a private venture, under the designation of P.1121. The prototype was scheduled to fly in 1958.

No details of the P.1121 are available, except that it will be powered by a single de Havilland Gyron turbojet.

THE HAWKER HUNTER.

The Hunter is in production for the Royal Air Force and has been supplied to the Governments of Denmark, Iraq, Peru and Sweden.

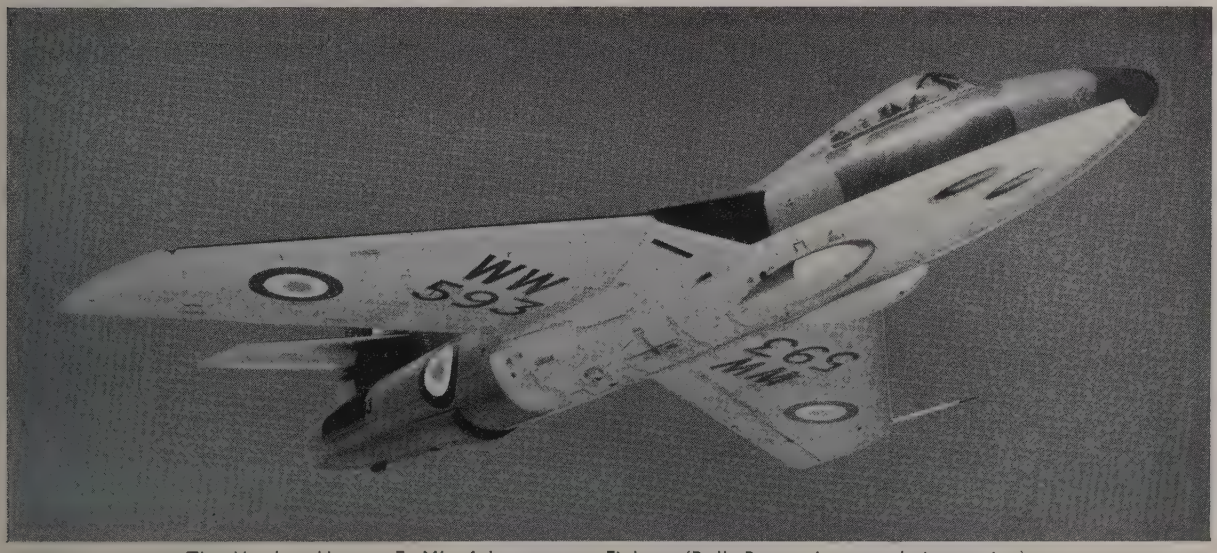
Under American "off-shore" purchasing arrangements licences for the manufacture of the Hunter have been signed with the Dutch and Belgian Governments. Production in Holland is by Fokker and Aviolanda, and in Belgium by Avions Fairey and SABCA.

The following versions of the Hunter have so far been announced:—

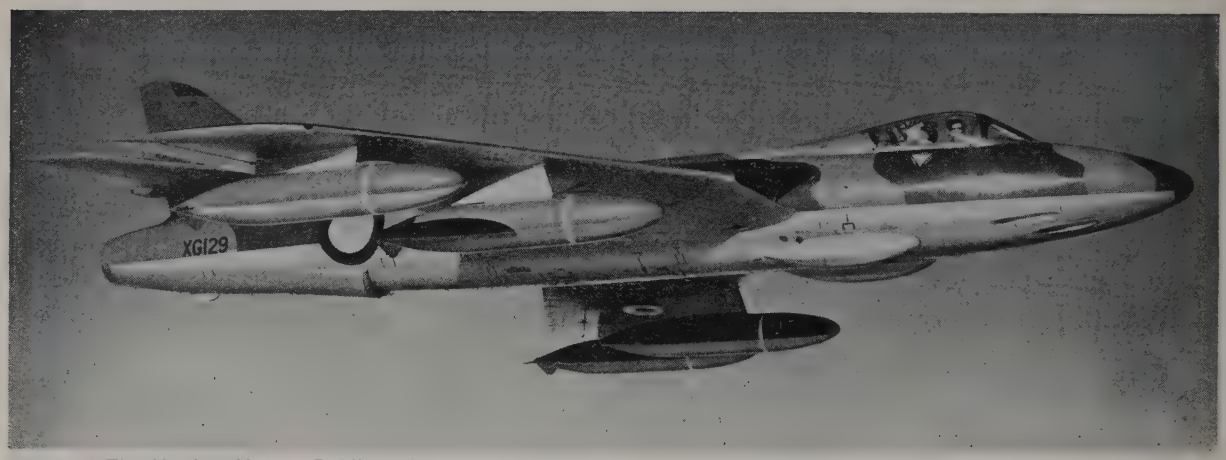
Hunter F. Mk. 1. One Rolls-Royce Avon RA.7 Series turbojet engine. Two prototypes were built, the first (WB188) flying for the first time on July 20, 1951, while a second (WB195) made its first flight in May, 1952. The first production F. Mk. 1 flew on November 30, 1952. Production complete.

Hunter F. Mk. 2. One Armstrong Siddeley Sapphire ASSa.6 turbojet engine. Hawker-built prototype (WB202) made its first flight on November 30, 1952. Production aircraft built by Sir W. G. Armstrong Whitworth Aircraft, Ltd. Production complete.

Hunter F. Mk. 3. One Rolls-Royce Avon RA.7R turbojet engine with afterburner. Only one, converted from prototype F. Mk. 1 (WB188). In September, 1953, this aircraft set up World's Speed Records over the 3-kilometre straight



The Hawker Hunter F. Mk. 6 Interceptor Fighter (Rolls-Royce Avon turbojet engine).



The Hawker Hunter F. Mk. 6 (Rolls-Royce Avon turbojet engine) with four 100 gallon underwing tanks.

course and the 100-kilometre closed-circuit course at 727.6 m.p.h. (1,171 km.h.) and 709 m.p.h. (1,141.4 km.h.) respectively.

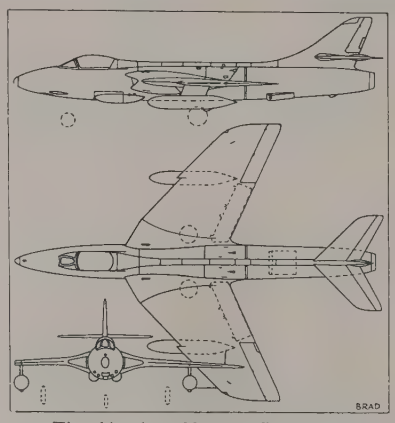
Hunter F. Mk. 4. One Rolls-Royce Avon turbojet engine. Mk. 1 with later modifications, including increased internal fuel capacity and provision for underwing stores and drop-tanks. Has also been adapted for photographic reconnaissance duties. Production complete.

Hunter F. Mk. 5. One Armstrong Siddeley Sapphire turbojet. Development of Mk. 2 with modifications introduced in Mk. 4. Built by Sir W. G. Armstrong Whitworth Aircraft, Ltd. Production complete.

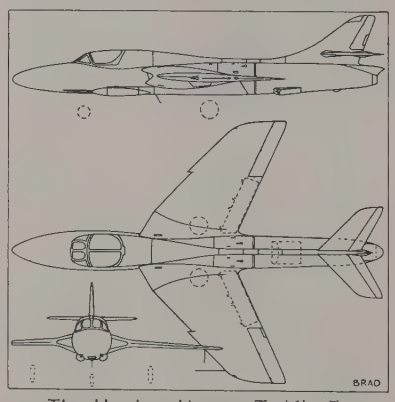
Hunter F. Mk. 6. One Rolls-Royce Avon RA.28 turbojet (10,000 lb.=4,540 kg. s.t.). Development of the Mk. 4. Late production Mk. 6 has extended, or "dog-tooth," leading-edges. Five Mk. 6's were presented to the Royal Iraqi Air Force by the British Government in 1957.

Hunter T. Mk. 7. Two-seat side-by-side version. New wider forward fuselage to accommodate new cockpit. Martin Baker Mk. 4 lightweight seats. Armament consists of one 30 mm. Aden cannon in fairing beneath cockpit. Drag parachute in fairing above jet pipe. First prototype (XJ615), basically a Mk. 4, flown on July 8, 1955. In October, 1956, XJ615 established two point-to-point speed records, from London to Rome in 1 hr. 34 min. (566 m.p.h.=905.6 km.h.) and from Rome to London in 1 hr. 40 min. (534 m.p.h.=854 km.h.). Second prototype (XJ627), based on Mk. 6, made its first flight on November 17, 1956.

Hunter F. Mk. 50. Mk. 4 supplied to the Royal Swedish Air Force. Its Swedish designation is J 34. Deliveries began in August, 1955.



The Hawker Hunter F. Mk. 6.



The Hawker Hunter T. Mk. 7.

Hunter F. Mk. 51. Mk. 4 supplied to the Royal Danish Air Force. Deliveries began in January, 1956.

Hunter F. Mk. 52. Mk. 4 supplied to the Peruvian Air Force. Deliveries began in February, 1956.

All versions of the Hunter are supersonic in shallow dives at height.

TYPE.—Single-seat Interceptor Fighter.

WINGS.—Mid-wing cantilever monoplane. Sweepback at 25% chord 40°. Aspect ratio 3.3. Thickness/chord ratio 8.5%. All-metal structure. "Dog-tooth" leading-edge, giving greater chord on outer wings of late Mk. 6 and 7 aircraft. Hydraulically-operated split flaps between powered ailerons and fuselage. Gross wing area 349 sq. ft. (32.4 m.²).

FUSELAGE. — All - metal semi - monocoque structure. In three structural units, nose section enclosing cockpit, armament pack and nose-wheel; centre section with integral wing roots, engine mountings and intake ducts; and detachable rear fuselage with integral fin base and removable jet-pipe and tail-cone unit. Air brake in form of a hinged flap conforming to curvature of underside of rear fuselage.

TAIL UNIT.—All surfaces swept, the tailplane being mounted on fin. Powered elevators. Aerodynamic tab on rudder. All-metal structure.

LANDING GEAR.—Retractable tricycle type. Main wheels raised inward into wing roots, nose-wheel forward into front fuselage. Hydraulic actuation with emergency pneumatic system. Track 14 ft. 9 in. (4.50 m.).

POWER PLANT.—One Rolls-Royce Avon (Mks. 1, 4, 6 and 7) or Armstrong Siddeley Sapphire (Mks. 2 and 5) axial-flow turbojet engine in centre fuselage, with air intakes in thickened wing-roots and jet exit in end of fuselage beneath tail-unit. Normal fuel



The first prototype Hawker Hunter T. Mk. 7 Trainer (Rolls-Royce Avon turbojet engine).

carried internally. High-pressure refueling valve in port main wheel bay. Auxiliary fuel may be carried in two or four 100 Imp. gallon (455 litre) pylon-mounted asbestos phenolic underwing tanks. Plessey propylnitrate liquid starter in Mk. 6, cartridge starter in earlier marks.

ACCOMMODATION.—(Fighter version) Pressurised and air-conditioned cockpit with sliding jettisonable canopy. Martin Baker ejection seat with combined hood-jettisoning and seat ejection sequencing device initiated by pulling down ejector seat blind.

ACCOMMODATION (Mk. 7 Trainer).—Pressurised cockpit for two side-by-side with dual controls. Two Martin Baker Mk. 4 automatic light-weight ejector seats.

ARMAMENT (Fighter version).—Four 30 mm. Aden cannon (100 r.p.g.) in self-contained package in underside of fuselage nose. Gun-pack can be winch-lowered for re-arming, servicing, etc. Automatic gun-ranging radar in front fuselage with scanner in nose radome, and gyro gun-sight. Provision under wings for the following stores: 36 × 3 in. rockets, or two 1,000 lb. (454 kg.) streamlined bombs, or practice bomb carriers or four 100 gallon asbestos phenolic fuel tanks, or any combination of the foregoing. Can also be adapted to carry two Fairey Fireflash or de Havilland Firestreak guided missiles, one under each wing.

ARMAMENT (Mk. 7 Trainer).—One 30 mm. Aden cannon in streamline fairing beneath cockpit. Two gun-sights, one for each occupant.

DIMENSIONS (Mks. 1, 2, 4, 5 and 6).—
Span 33 ft. 8 in. (10.26 m.).
Length 45 ft. 10½ in. (13.99 m.).
Height 13 ft. 2 in. (4.26 m.).

DIMENSIONS. (Mk. 7).—
Span 33 ft. 8 in. (10.26 m.).
Length 48 ft. 10½ in. (14.91 m.).
Height 13 ft. 2 in. (4.26 m.).

HAWKER SIDDELEY

HAWKER SIDDELEY GROUP, LTD.

GROUP HEADQUARTERS: 18, ST. JAMES'S SQUARE, LONDON, S.W.1.

Directors: Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S. (Chairman), Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S. (Managing Director), H. Burroughes, F.R.Ae.S. (Deputy Managing Director), Sir Roy Dobson, C.B.E., Hon. F.R.Ae.S., J.P., H. A. Meredith, O.B.E., H. T. Chapman, C.B.E., F.R.Ae.S., M.I. Mech.E., J. F. Robertson, C.A., Sir Arnold Hall, F.R.S., M.A., Hon.A.C.G.I., F.R.Ae.S., H. G. Herrington, C.B.E., F.R.Ae.S. and G. C. R. Eley, C.B.E.

The Hawker Siddeley Group, which was formed in 1935, is the controlling organisation of Hawker Aircraft, Ltd., Gloster Aircraft Co., Ltd., A. V. Roe & Co., Ltd., Sir W. G. Armstrong Whitworth Aircraft Ltd., Armstrong Siddeley Motors, Ltd., Armstrong Siddeley (Brockworth) Ltd., Air Service Training Ltd. and High Duty Alloys, Ltd.; and in Canada, A. V. Roe Canada, Ltd., Avro Aircraft, Ltd., Orenda Engines, Ltd., Canadian Steel Improvement, Ltd., Canadian Car Co., Ltd. and PSC Applied Research Ltd., and several other subsidiary and associate companies whose work is not directly related to aircraft.

Products of the aircraft and aero-engine manufacturing components of the Group will be found under their individual names in this and the Engine Sections of this book.

HUNTING PERCIVAL

HUNTING PERCIVAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: LUTON AIRPORT, LUTON, BEDFORDSHIRE.

Directors: P. Ll. Hunting (Chairman), G. L. Hunting, C. P. M. Hunting, W. A. Summers (Managing), K. D. Morgan (Secretary), R. R. S. Cook, L. C. Hunting, F. W. Buglass, M.I.P.E. (Works) and F. H. Pollicutt, F.R.Ae.S. (Technical).

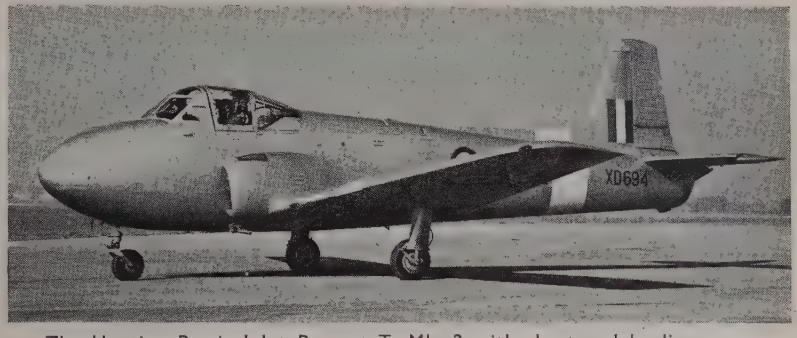
The Percival Aircraft Company was formed in 1932. It was re-organized as Percival Aircraft Ltd. in 1937, and the works were moved from Gravesend to Luton. In 1944 the company became part of the Hunting Group and a branch office was opened at Toronto, Canada, in 1946. The name was changed to Hunting Percival Aircraft, Ltd. in 1954.

The current Hunting Percival productions are the Provost, the Jet Provost, the Pembroke and the President.

The Provost, a side-by-side two-seat basic trainer, has now replaced the Prentice in all basic flying schools in the R.A.F. and is also in service in the Air Forces of Rhodesia, Burma, Eire, Iraq and Sudan. The Jet Provost, which has been developed from the piston-engined Provost, is also in service in the R.A.F.

The Pembroke is in service in the Royal Air Force, the Royal Rhodesian Air Force, the Belgian Air Force, the Finnish Air Force, the Swedish Air Force, the Royal Danish Air Force and the West German Air Force.

The civil version of the Pembroke is known as the President.



The Hunting Percival Jet Provost T. Mk. 2 with shortened landing gear.

THE HUNTING PERCIVAL P.85 JET PROVOST.

The prototype Jet Provost Mk. 1 powered by an Armstrong Siddeley Viper ASV.5 engine (1,640 lb.=745 kg. s.t.) flew for the first time on June 26, 1954. This aircraft, of which a small pre-production batch was ordered by the Royal Air Force for evaluation by Flying Training Command, was a direct development of the Leonides-engined Provost and made use of as many of the structural components of that aircraft as possible. In parallel with its service evaluation as a trainer, considerable development of the aircraft was undertaken, which resulted in the production of a Mk. 2 version, which had a redesigned rear fuselage, a shorter landing gear, hydraulic instead of pneumatic services and the higher-powered Viper ASV.8 engine (1,750 lb.=795 kg. s.t.). The Mk. 2, of which a small number was also ordered, has served as the prototype for the Mk. 3.

The Mk. 3 has the same power-plant, shortened landing gear and hydraulic services of the Mk. 2 but is equipped with Martin Baker lightweight ejector seats, clear-view front windscreen and wing-tip fuel tanks.

Following the success of its eighteen months' evaluation in the R.A.F., the Jet Provost has been adopted for *ab initio*/basic jet training up to the advanced flying stage, and a substantial production order for the Mk. 3 has been placed. The Royal Air Force is the first service in the World to adopt the principle of "all-through" jet training.

The description and specification which follow refer to the Jet Provost T. Mk. 3.

TYPE.—Two-seat Jet Primary and Basic Trainer.

WINGS.—Basically same as for P.56 Provost. Aspect ratio 5.78. Chord 7 ft. 8 in. (2.33 m.) at root, 4 ft. 4 in. (1.31 m.) at tip. Dihedral 6°. Incidence 2.5° at root, 0.5° at tip. Air brakes on wings at rear spar position ahead of flaps. Both air brakes and flaps are hydraulically-operated. Total flap area 25.72 sq. ft. (2.39 m.²). Total aileron area 18.70 sq. ft. (1.73 m.²). Gross wing area 213.7 sq. ft. (19.80 m.²).

FUSELAGE.—All-metal structure.

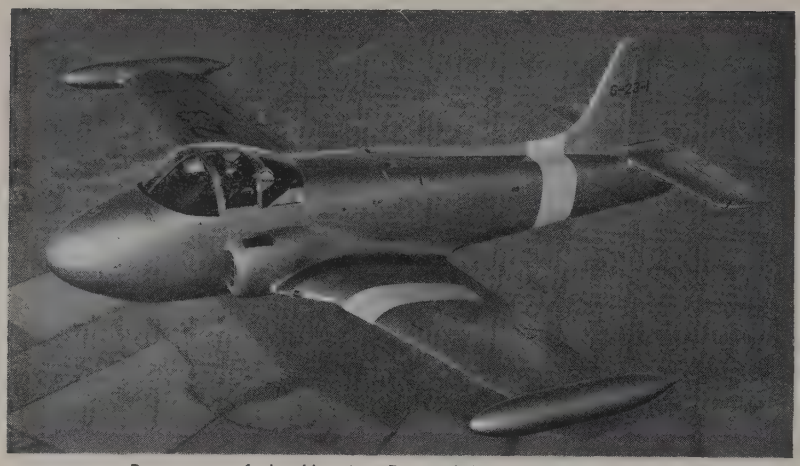
TAIL UNIT.—Same as for P.56 Provost.

LANDING GEAR.—Retractable nose-wheel type. Dowty pneumatic retraction. Dunlop wheels and hydraulic brakes. Wheelbase 10 ft. (3.05 m.). Track 10 ft. 8.7 in. (3.23 m.).

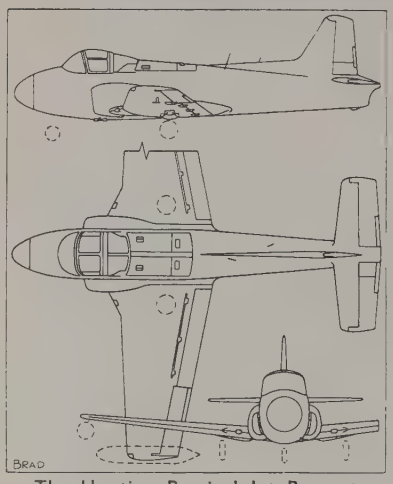
POWER PLANT.—One Armstrong Siddeley Viper ASV.8 Mk. 9 axial-flow turbojet engine (1,750 lb.=794 kg. s.t.) in fuselage aft of cockpit. "Elephant-ear" intakes on each side of forward fuselage and jet exit at rear of fuselage aft of tailplane. Normal internal capacity (three tanks in each wing) 186 Imp. gallons (846 litres). Two 50 Imp. gallon (227 litres) wing-tip tanks may be fitted to order. Oil capacity 14 pts. (8 litres).



The Hunting Percival Jet Provost T. Mk. 1 (Armstrong Siddeley Viper engine).



Prototype of the Hunting Percival Jet Provost T. Mk. 3.



The Hunting Percival Jet Provost T. Mk. 3.

ACCOMMODATION.—Enclosed cockpit in front of leading-edge of wings seating two side-by-side with dual controls. Martin-Baker Mk. 4 lightweight ejector seats. Layout of cockpit similar to that of P.56 Provost T.Mk. 1 except that a single centrally-placed blind-flying panel is used. For armament training two .303 in. machine-guns can be fitted in nose of fuselage, plus two standard reflector sights, one in front of each seat. A variety of underwing stores could be carried such as 4×60-lb. (27 kg.) rockets and 8×25-lb. (11 kg.) practice bombs or 2×250-lb. (113 kg.) general purpose bombs.

DIMENSIONS.—
Span over tanks 36 ft. 11 in. (11.25 m.).
Length 32 ft. 5 in. (9.88 m.).
Height 10 ft. 2 in. (3.11 m.).

WEIGHTS.—
Weight loaded (full internal fuel) 6,195 lb. (2,810 kg.).
Weight loaded (max. fuel including tip tanks) 7,092 lb. (3,200 kg.).

PERFORMANCE (at 6,195 lb. = 2,810 kg. A.U.W.).—
Max. level speed 326 m.p.h. (522 km.h.) at 25,000 ft. (7,620 m.).
Max. design speed 437 m.p.h. (705 km.h.) up to 10,000 ft. (3,050 m.).
Stalling speed 75 m.p.h. (120 km.h.).
Rate of climb at S/L. 2,400 ft./min. (12.2 m./sec.).
Rate of climb at 30,000 ft. (9,150 m.) 500 ft./min. (2.54 m./sec.).
Time to 10,000 ft. (3,050 m.) 5.0 min.
Time to 20,000 ft. (6,100 m.) 11.5 min.
Time to 30,000 ft. (9,150 m.) 23.0 min.
Rate of roll 155°/sec.
Range at 30,000 ft. (9,150 m.) (internal fuel only) 397 miles (639 km.).
Range at 25,000 ft. (7,620 m.) (tip tanks full) 565 miles (910 km.).
Endurance at 30,000 ft. (9,150 m.) (internal fuel only) 1.64 hours.
Endurance at 30,000 ft. (9,150 m.) (tip tanks full) 2.6 hours.
T.O. distance to 50 ft. (15.25 m.) 1,990 ft. (606 m.).
Landing distance from 50 ft. (15.25 m.) 2,160 ft. (658 m.).

THE HUNTING PERCIVAL P.56 PROVOST.

The P.56 trainer was designed to Specification T.16/48 to meet R.A.F. requirements. Three prototypes were built, one fitted with the Armstrong Siddeley Cheetah 18 engine and the other two with the Alvis Leonides engine. The first (Cheetah-engined) prototype flew for the first time on February 23, 1950.

As the result of comprehensive trials the Leonides-engined P.56 was selected as the standard R.A.F. basic trainer under the designation Provost T. Mk. 1. This aircraft, of which several hundreds have been built, is in full production.

The armed version of the Provost for weapon training can be equipped with the following armament: 2 × .303-in. machine-guns; 1 camera-gun and 2 × 250-lb. bombs; or 8 × 25-lb. bombs; or 8 × 25-lb. bombs and 4 × 60-lb. R.P.; or 6 × 60-lb. R.P.

The following are the designations of the Provosts which have been exported:—

Provost T. Mk. 51. T. Mk. 1 (unarmed) supplied to Eire Air Corps.

Provost T. Mk. 52. Armed version supplied to the Royal Rhodesian Air Force.

Provost T. Mk. 53. Armed version supplied to the Eire Air Corps, the Burma Air Force, the Royal Iraqi Air Force and the Sudanese Air Force.

The following description applies specifically to the Provost T. Mk. 1.

TYPE.—Two-seat Basic Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section NACA 23015 (mod.) at root. NACA 4412 (mod.) at tip. Aspect ratio 5.78. Dihedral 6°. Incidence 3°. All-metal stressed skin construction. Metal covered ailerons and trim-tabs. Pneumatically-operated slotted flaps. Total flap area 18.94 sq. ft. (1.74 m.²). Gross wing area 214 sq. ft. (20 m.²).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal one-piece tailplane, interchangeable elevators, fin and rudder, the fixed surfaces covered with smooth and movable surfaces with fluted alloy skin. Trim and balance tabs in elevators, combined trim and balance tab in rudder. Span of tailplane 13 ft. 6 in. (4.1 m.). Total horizontal area 48.6 sq. ft. (4.51 m.²). Total vertical area 35.09 sq. ft. (3.26 m.²).

LANDING GEAR.—Fixed tail-wheel type. British Messier oleo-pneumatic shock-absorbers. Differential pneumatic brakes. Dowty liquid-spring tail-wheel strut. Track 11 ft. 1½ in. (3.38 m.).

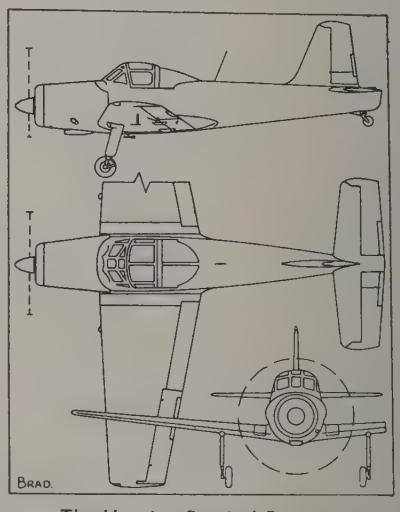
POWER PLANT.—One 550 h.p. Alvis Leonides 25 nine-cylinder air-cooled geared and supercharged radial engine. Three-blade metal constant-speed airscrew, 9 ft. (2.74 m.) diameter. Fuel capacity 66 Imp. gallons (300 litres).

ACCOMMODATION.—Crew of two in enclosed cockpit. Instructor (on starboard) and pupil sit side-by-side, with full dual controls and dual instrument panels. Sliding canopy is mechanically-operated and jettisonable.

DIMENSIONS.—
Span 35 ft. 2 in. (10.9 m.).
Length 29 ft. (8.85 m.).
Overall height (tail up) 12 ft. (3.66 m.).

WEIGHTS AND LOADINGS.—
Weight empty (equipped) 3,350 lb. (1,521 kg.).
Crew (2) 400 lb. (182 kg.).
Fuel and oil 529 lb. (240 kg.).
Weight loaded 4,400 lb. (2,000 kg.).
Wing loading 20.6 lb./sq. ft. (100.5 kg./m.²).
Power loading 8.0 lb./h.p. (3.63 kg./h.p.).

PERFORMANCE.—
Max speed 195 m.p.h. (312 km.h.) at sea level and 200 m.p.h. (322 km.h.) at 2,300 ft. (700 m.).



The Hunting Percival Provost.



The Hunting Percival Provost T. Mk. 53 for the Burma Air Force.



The Hunting Percival Pembroke C. Mk. 1 (two 560 h.p. Alvis Leonides engines).

Max. continuous cruising speed 194 m.p.h. (310 km.h.) at 7,900 ft. (2,410 m.).
Max. economical cruising speed 177 m.p.h. (283 km.h.) at 11,500 ft. (3,510 m.).
Stalling speed, flaps down 67 m.p.h. (108 km.h.).
Initial rate of climb 2,200 ft./min. (11.2 m./sec.).
Rate of climb at 5,000 ft. (1,525 m.) 1,870 ft./min. (9.5 m./sec.).
Climb to 5,000 ft. (1,525 m.) 3.3 minutes.
Climb to 10,000 ft. (3,050 m.) 7.0 minutes.
Rate of roll (per second) 90 degrees.
Service ceiling 22,500 ft. (6,860 m.).
Take-off to 50 ft. (15.2 m.), grass surface 283 yds. (260 m.).
Landing run 265 yds. (242 m.).
Duration (at economical weak cruise) 4 hrs.

THE HUNTING PERCIVAL P.66 PEMBROKE.

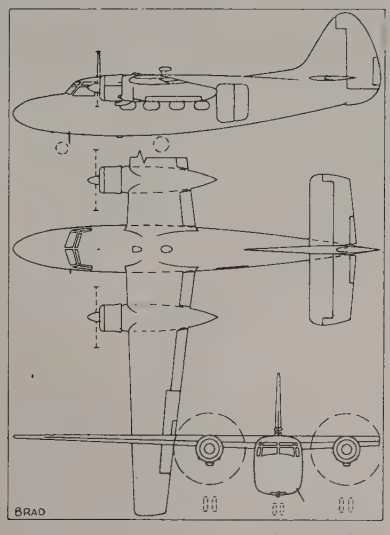
The Pembroke is an eight-seat communications and light transport aircraft which is in service with the Royal Air Force. It is adaptable for freighting, long-range ferrying, casualty evacuation and photographic survey duties.

Fixed fittings in the cabin are provided for eight 15G rearward-facing seats, for stretchers or for lashing down cargo. The main cabin door is removable for parachuting freight and equipment.

A fixed supply of oxygen is provided for the crew, with portable oxygen equipment for the passengers.

Two versions of the Pembroke are in service with the Royal Air Force, as follows :—

Pembroke C. Mk. 1. Standard eight-seat communications version.



The Hunting Percival Pembroke C. Mk. 1.

Pembroke C. (P.R.) Mk. 1. Basically similar to C. Mk. 1, but with provision for vertical and sideways-facing oblique cameras in cabin for dual rôle as photographic survey aircraft.

The Pembroke in service with the Royal Rhodesian Air Force is identical to the R.A.F. Pembroke C. Mk. 1 except that de-icing equipment is not fitted.

The following are the designations of the versions of the Pembroke which have been exported to Belgium, Sweden, Finland, Denmark and West Germany.

Pembroke C. Mk. 51. Supplied to the Belgian Air Force. Basic accommodation for crew of 4 and 6 passengers. Provided with clear-view photographic sighting nose, together with optically flat window in nose compartment and vertical and oblique camera apertures in main cabin for air survey and photography. Removable dual controls to permit aircraft to be used for twin-engine pilot training, and with two-stage amber screening for cloud and night flying training.

Pembroke C. Mk. 52. Supplied to Royal Swedish Air Force. R.S.A.F. designation: Tp. 81. Basically similar to C. Mk. 1 but with accommodation for crew of 2 and 10 passengers.

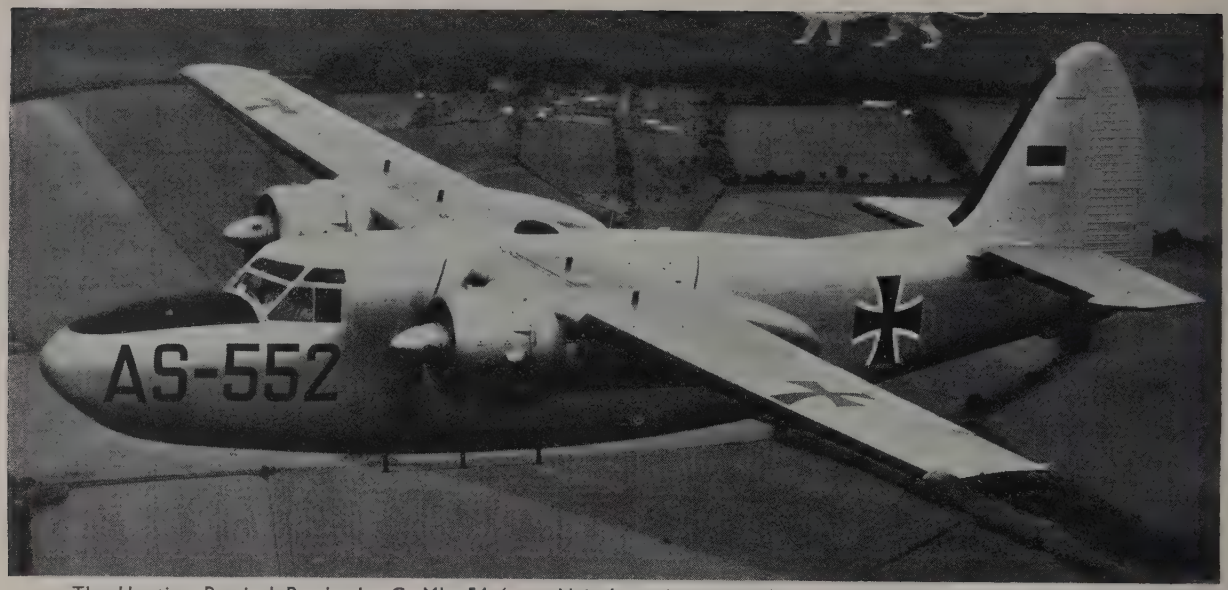
Pembroke C. Mk. 52/2. Supplied to Royal Danish Air Force. Majority are of standard 2-crew 10-passenger communications/training version similar to C. Mk. 52, but small number supplied as V.I.P. aircraft with luxury accommodation for six passengers.

Pembroke C. Mk. 53. Supplied to Finnish Air Force. Basic accommodation for crew of 3 and 7 passengers, and similar to C. Mk. 51 with facilities and equipment for air survey and photography, etc.

Pembroke C. Mk. 54. Supplied to West German Air Force. Basic accommodation for crew of 2 and 10 passengers,



The Hunting Percival Pembroke C. Mk. 53 (two Alvis Leonides engines) as supplied to the Finnish Air Force.



The Hunting Percival Pembroke C. Mk. 54 (two Alvis Leonides engines) as supplied to the German Air Force.

with built-in facilities for ambulance, survey, aircrew-training and freighting duties. 33 ordered.

TYPE.—Twin-engined Communications and Training monoplane.

WINGS.—High-wing cantilever monoplane. NACA 23017 wing section. Aspect ratio 10.4. Chord 8 ft. 1 in. (2.94 m.) at root, 4 ft. 1 in. (1.27 m.) at tip. Incidence 3° at root, 1° 40′ at tip. Two-spar stressed-skin light alloy construction. Slotted light alloy flaps. Mass-balanced light alloy ailerons. Total flap area 38.2 sq. ft. (3.55 m.²). Total aileron area 50.2 sq. ft. (4.66 m.²). Gross wing area 400 sq. ft. (37.2 m.²).

FUSELAGE. — All - metal semi - monocoque stressed-skin structure.

TAIL UNIT.—Cantilever monoplane structure. Single-piece tailplane, two identical elevators, single fin and rudder, all of stressed-skin light-alloy construction. Areas: fin 29.48 sq. ft. (2.74 m.²), rudder 31.72 sq. ft. (2.94 m.²), tailplane 57.4 sq. ft. (5.34 m.²), elevators 44.7 sq. ft. (4.15 m.²). Tailplane span 18 ft. 9 in. (5.74 m.).

LANDING GEAR.—Retractable tricycle type. Pneumatic retraction. Electro Hydraulics oleo-pneumatic shock-absorbers. Palmer wheels and pneumatic brakes. Wheelbase 12 ft. (3.66 m.). Track 16 ft. 6 in. (5.05 m.).

POWER PLANT.—Two 540/560 h.p. Alvis Leonides Mk. 12701 nine-cylinder radial air-cooled engines. D.H. or Rotol three-blade constant-speed fully-feathering air-screws. Fuel in four interconnected crash-proof tanks, two in each wing. Inboard tanks 53 Imp. gallons (240 litres) each, outboard tanks 63 Imp. gallons (286 litres) each. Total fuel capacity 232 Imp. gallons (1,055 litres). Two oil tanks, one in each nacelle, 13 Imp. gallons (59 litres) each.

ACCOMMODATION.—Crew of two to four. Cabin may seat 6 to 10 passengers in backward-facing seats with baggage, or six stretcher cases, or may be equipped for survey or photographic work or may be stripped for carriage of freight.

DIMENSIONS.—
Span 64 ft. 6 in. (19.6 m.).
Length 46 ft. 0 in. (14.0 m.).
Height 16 ft. 1 in. (4.9 m.).

WEIGHTS (Communications version).—
Weight empty (equipped) 9,178 lb. (4,160 kg.).
Fuel, oil and crew 2,299 lb. (1,044 kg.).
Eight passengers and baggage 1,732 lb. (786 kg.).
Weight loaded 13,500 lb. (6,125 kg.).

PERFORMANCE.—
Max. speed at 2,000 ft. (610 m.) 224 m.p.h. (360 km.h.).
Max. rich mixture cruising speed 209 m.p.h. (337 km.h.) at 5,000 ft. (1,525 m.).
Max. weak mixture cruising speed 199 m.p.h. (320 km.h.) at 10,000 ft. (3,050 m.).
Most economic cruising speed 155 m.p.h. (250 km.h.) at 8,000 ft. (2,440 m.).
Initial rate of climb 1,070 ft./min. 5.44 m./sec.).
Climb to 6,000 ft. (1,830 m.) 5.6 min.
Climb to 10,000 ft. (3,050 m.) 10.5 min.
Climb to 20,000 ft. (6,100 m.) 34.4 min.
Service ceiling 22,000 ft. (6,070 m.).
Range (still air) 1,150 miles (1,850 km.).
Take-off distance to 50 ft. (15.25 m.) at S/L. 2,520 ft. (678 m.).

THE HUNTING PERCIVAL PRESIDENT.

The President is a development of the Pembroke for the civil market. Various refinements of design have enabled the maximum all-up weight to be increased to 13,500 lb. (6,130 kg.). The versatility of the Pembroke has been retained, thus enabling the President to be operated in a variety of rôles, amongst which are those of 6-passenger executive aircraft, 12-passenger feeder airliner, air survey and photography, freighter and air ambulance for 6 stretcher cases.

An order for three Presidents for Trabajos Areos y Enlaces, of Bilbao, Spain, was announced in August, 1957.

TYPE.—Twin-engined General Purpose monoplane for Executive, Feeder-line, Charter and Freight-carrying duties.

WINGS, FUSELAGE, TAIL UNIT, LANDING GEAR AND POWER PLANT.—
As for Pembroke.

ACCOMMODATION.—Crew of two side-by-side with provision for dual controls. Entry door in bulkhead aft of cockpit. Main passenger cabin can seat 12 passengers (standard version) in forward or backward



The Hunting Percival President (two 560 h.p. Alvis Leonides engines).

facing seats or 6 passengers in executive version. Entry at aft end of cabin on port side. Baggage compartment aft of cabin with access door immediately adjacent to passenger door. All interior equipment can be removed and entire cabin space used for freight-carrying. Dimensions of cabin: 20 ft. 1 in. (6.1 m.) long, 6 ft. 0 in. (1.8 m.) high, and 5 ft. 6 in. (1.68 m.) wide.

DIMENSIONS.—
Same as Pembroke.

WEIGHTS (Standard 12-passenger version).—
Weight empty (equipped) 9,020 lb. (4,095 kg.).
Disposable load 4,471 lb. (2,030 kg.).
Weight loaded 13,500 lb. (6,125 kg.).

PERFORMANCE (at 13,500 lb.=6,125 kg.).—
Max. speed at 13,000 lb.=5,900 A.U.W. at 1,750 ft. (534 m.) 221 m.p.h. (356 km.h.).
Cruising speed at max. cont. power at 6,000 ft. (1,830 m.) 214 m.p.h. (345 km.h.).
Cruising speed using max. weak mixture power at 11,000 ft. (3,355 m.) 191 m.p.h. (308 km.h.).
Most econ. cruising speed for range at 8,000 ft. (2,440 m.) 152 m.p.h. (245 km.h.).
Stalling speed (power off, wheels and flaps down) 79.3 m.p.h. (128 km.h.).
Single-engine rate of climb at T.O. power, wheels up, flaps at take-off position, one propeller feathered 195 ft./min. (0.99 m./sec.).
Service ceiling 22,500 ft. (6,860 m.).
T.O. distance to 50 ft. (15.25 m.) from hard runway 2,520 ft. (768 m.).
T.O. distance to 50 ft. (15.25 m.) with critical engine failing at safety speed 3,750 ft. (1,145 m.).
Landing distance from 50 ft. (15.25 m.) in still air on hard runway 2,560 ft. (780 m.).
Max. still air range (with S.B.A.C. allowances) on internal fuel 900 miles (1,445 km.).
Max. range with underwing slipper tanks 1,518 miles (2,444 km.).

JACKAROO

JACKAROO AIRCRAFT LTD.

HEAD OFFICE AND WORKS: THRUXTON AERODROME, ANDOVER, HANTS.

Directors: Sq.-Ldr. J. E. Doran-Webb (Managing); Air Vice-Marshal N. C. Ogilvie-Forbes; Sq.-Ldr. M. F. Ogilvie-Forbes; R. Giddings; E. J. Heaton; D. Vaughan (Overseas Sales).

With the assistance of Mr. R. Prizeman, who was responsible for the drawings and stress calculations, the Wiltshire School of Flying has produced a modification scheme which converts a standard de Havilland Tiger Moth biplane into a dual-purpose four-seat light aircraft or single-seat agricultural aircraft, at low cost. A company named Jackaroo Aircraft Ltd. has been formed to handle production of the conversion kits.

Known as the Thruxton Jackaroo, the first aircraft modified to this design flew on March 2, 1957, and was followed by the first production conversion on March 14, 1957. Owners of Tiger Moths are able to have their aircraft converted into Jackaroos at Thruxton, or can buy a conversion kit to do the work themselves.

THE THRUXTON JACKAROO.

The Jackaroo is essentially a Tiger Moth in which the centre-fuselage has been widened to accommodate either four seats, in two pairs, or a pilot and a hopper for 550 lb. (250 kg.) of dust for crop-spraying and top-dressing duties. The overall width of the fuselage is 36 in. (0.91 m.) compared with 23½ in. (0.60 m.) on the standard Tiger Moth.

Normal welded steel-tube construction is used for the new centre-fuselage section, and an additional steel-tube bay is inserted in the fuselage forward of the centre-section wing struts, so that the engine is mounted further forward to offset the greater weight aft of the C.G.



The Thruxton Jackaroo (130 h.p. D.H Gipsy Major 1 engine).

In each case the new structure picks up on existing fuselage fittings and the dual controls are maintained in tandem. Entry into the enclosed cabin of the passenger configuration is by forward-hinged doors.

No modifications are made to the wings, interplane struts, tail surfaces or rear fuselage. But the wider fuselage requires an extension of the centre-section by 12½ in. (0.32 m.) and this has the effect of increasing the wing span to 30 ft. 4½ in. (9.25 m.), the wing area to 246.7 sq. ft. (22.92 m.²) and the aspect ratio to 7.47.

Similarly, the landing gear track is increased to 6 ft. 3½ in. (1.92 m.). The wheels are fitted with simple mechanical disc brakes of Goodyear design, and a tailwheel will be fitted to production Jackaroos in place of the usual skid.

The standard power plant, built around a 130 h.p. de Havilland Gipsy Major 1 engine, is retained, the only modification being a simple revision of the cowling to provide additional cooling for tropical operation. Forward view from the cockpit has been improved by lowering the top of the decking by 4½ in. (11.4 cm.).

DIMENSIONS.—
Span 30 ft. 4½ in. (9.25 m.).
Length 25 ft. 5 in. (7.75 m.).
Height 8 ft. 10 in. (2.69 m.).

WEIGHTS.—
Weight empty 1,360 lb. (617 kg.).
Weight loaded 2,180 lb. (989 kg.).

PERFORMANCE.—
Max. speed 95 m.p.h. (153 km.h.).
Economical cruising speed 85 m.p.h. (137 km.h.).
Stalling speed 45 m.p.h. (72.5 km.h.).
Rate of climb at S/L 400 ft./min. (120 m./min.).
Take-off to 20 ft. (6.0 m.) in 6 m.p.h. (9.5 km.h.) wind 900 ft. (275 m.).
Max. endurance 3 hr.

M.L.

M.L. AVIATION COMPANY, LTD.

HEAD OFFICE: UNITED BUILDING, TRADING ESTATE, SLOUGH, BUCKINGHAMSHIRE.

WORKS AND AERODROME: WHITE WALTHAM, MAIDENHEAD, BERKSHIRE.

Directors: Sir Noel Mobbs, K.C.V.O., O.B.E. (Chairman); E. N. Mobbs (Managing Director): M. J. O. Lobelle, M.I. Mech.E., F.R.Ae.S. (Chief Designer); R. O. Mobbs, J.P. and D. L. Donne.

M.L. Aviation Co., Ltd., formerly R. Malcolm, Ltd., are designers and manufacturers of radio-controlled pilotless targets, high-speed target-towing apparatus, as well as various other kinds of aircraft equipment.

The company has produced the M.L. Utility Aircraft Mk. 1 inflatable-wing monoplane, for which the Ministry of Supply has placed a prototype contract.

THE M.L. UTILITY MARK 1.

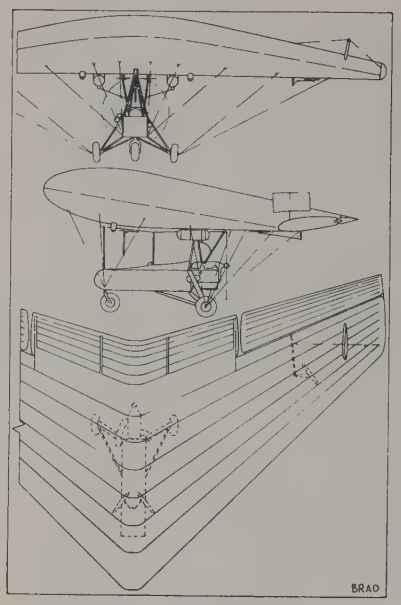
This aircraft is a development of the M.L. Utility, which was described and illustrated in the 1955-56 edition of this Annual, using the same type of unique inflatable wing. Designed by Mr. M. J. Lobelle, who was formerly chief designer of The Fairey Aviation Co., Ltd., it is intended for operation from small landing fields as a military reconnaissance and communications aircraft or civil utility aircraft. The aim was to provide an aircraft of low initial cost which is easy to maintain and occupies little space during storage and transportation.



The M.L. Utility Mk. 1 Inflatable-wing Monoplane.

The wing, which was developed originally by the Ministry of Supply Research and Development Establishment at Cardington, is entirely without rigid bracing and retains its form by the maintenance of pressure inside an inflated fabric envelope, to provide a stiff aerodynamic surface. The wing can be deflated after flight, rolled up into a bag and packed into the fuselage nacelle for transportation. Being of light construction, this nacelle is easily manhandled by a single person and can be towed behind a private car. It could be accommodated complete inside an average domestic garage.

The aircraft is controlled solely by means of elevons, which are operated by a cable and lever system connected to an inverted control column suspended from the top of the fuselage superstructure.



The M.L. Utility Mk. 1.



The M.L. Utility Mk. 1 Inflatable-wing Monoplane.

Correct differential air pressure of 0.5 lb./sq. in. (0.035 kg./cm.²) in the wing is maintained by a built-in electrically-driven pump and relief valves. Dismantling from the fuselage and deflation takes only a few minutes. Complete re-erection and inflation of the wing takes approximately thirty minutes.

By May, 1957 the prototype had completed 40 hours of flying.

TYPE.—Two-seat Inflatable wing monoplane.

WINGS.—Braced high wing monoplane of delta planform. Symmetrical wing section developed from N.A.C.A. 0024. Chord 17 ft. 6 in. (5.33 m.) at root, 5 ft. 9 in. (1.75 m.) at tip. No dihedral. Consists of rubber-proofed fabric envelope, with top and bottom surfaces connected by a number of porous fabric diaphragms which run spanwise and extend continuously from tip to tip. These diaphragms maintain the wing section by tension. The wing carries the fuselage by means of a series of straps and toggles secured to the undersurface. Flying wires attached to patches on the wing are secured to the fuselage and landing gear members. Inflated elevons extend for almost the entire span. No flaps. Total area of elevons 43 sq. ft. (4.0 m.²). Wing area 400 sq. ft. (37.16 m.²).

FUSELAGE.—Light car, mainly of wooden construction, with fabric covering.

TAIL UNIT.—None. But two small vertical stabilizers are fitted near wing-tips.

LANDING GEAR.—Fixed tricycle type. No shock-absorbers. Swivelling nose-wheel steered by rudder bar. Palmer 600-6.5 wheels. Palmer mechanical brakes. Parking brakes on rear wheels. Wheelbase 6 ft. 10 in. (2.08 m.). Wheel track 5 ft. 4 in. (1.62 m.).

POWER PLANT.—One 38.5 h.p. (de-rated) Walter Mikron III four-cylinder in-line inverted air-cooled engine mounted on rear of fuselage car and driving Airscrew & Jigwood Company two-blade fixed-pitch wooden airscrew. Methanol benzole-gasoline fuel in two tanks suspended below wing, with total capacity of 12 Imp. gallons (54.55 litres). Oil capacity 3 Imp. quarts (3.4 litres).

ACCOMMODATION.—Two seats in tandem in open car. Pilot in front and passenger at rear. Instruments comprise airspeed indicator, altimeter, compass, wing pressure gauge, engine r.p.m. indicator and oil pressure gauge.

DIMENSIONS.—
Span 35 ft. (10.67 m.).
Length 23 ft. 3 in. (7.09 m.).
Height 10 ft. 6 in. (3.20 m.).

WEIGHTS.—
Weight empty 515 lb. (234 kg.).
Fuel 85 lb. (39 kg.).
Crew (2) 360 lb. (163 kg.).
Baggage 40 lb. (18 kg.).
Weight loaded 1,000 lb. (454 kg.).

PERFORMANCE.—
Max. speed (38.5 h.p.) 58 m.p.h. (93 km.h.).
Cruising speed (35 h.p.) 50 m.p.h. (80 km.h.).
Stalling speed 30 m.p.h. (48 km.h.).
Rate of climb at S/L. 690 ft./min. (210 m./min.).
Ceiling 5,000 ft. (1,525 m.).
Take-off distance 270 ft. (82 m.).
Take-off distance to 50 ft. (15.25 m.) 495 ft. (151 m.).
Endurance at cruising speed 2½ hours.

MILES

F. G. MILES, LIMITED.

HEAD OFFICE AND WORKS: SHOREHAM AIRPORT, SUSSEX.

Directors: F. G. Miles, F.R.Ae.S. (Chairman and Managing Director), Mrs. M.F. M. Miles, Dennis Daybell, G. H. Miles, M.S.A.E. (Chief Designer), J. W. P. Angell and Mrs. O. M. Wadlow (Secretary).

F. G. Miles, Ltd. was formed in 1951 to design and build aircraft, to undertake aerodynamic and flight research and to conduct experimental work in structural plastics.

Mr. F. G. Miles has been associated with the aircraft industry since 1933 when Phillips & Powis Aircraft (Reading) Ltd. introduced the original Miles Hawk. Phillips & Powis Aircraft, Ltd. was formed as a public company in 1935 to take over the aircraft manufacturing business of Phillips & Powis Aircraft (Reading) Ltd. and in 1943 the company's name was changed to Miles Aircraft, Ltd.

Between 1933 and 1948, when Miles Aircraft Ltd. ceased to exist as an aircraft manufacturing company, a great variety of both civil and military aircraft types bearing the Miles name emanated from the Reading factory, the best-known being the Hawk Series, Falcon, Magister, Master, Martinet, Messenger, Gemini, Aerovan and Marathon, the last-mentioned being subsequently produced by Handley Page (Reading), Ltd.

The first products of F. G. Miles, Ltd. were conversions of earlier Miles designs.

The company is now developing as a private venture the M.100 Student basic training or communications monoplane, of which the prototype, powered by a Turbomeca Marboré IIA turbojet engine, made its first flight on May 14, 1957.

In conjunction with the French Société des Avions Hurel-Dubois, Miles has built a development of the M.57 Aerovan, which is fitted with an Hurel high aspect ratio strutted wing and is known as the HDM.105. The prototype of this aircraft flew on March 31, 1957.

Larger aircraft on similar lines, known as the HDM.106 and HDM.107, have been projected and, in association with the Société des Avions Hurel-Dubois, Miles have formed a company known as H.D. et M. (Aviation) Ltd. to develop these types and to act as sales agents for the French-designed Hurel-Dubois aircraft.

Following a considerable expansion of its activities, the company's Plastics Division has now been formed into a separate company, named Miles Structural Plastics Ltd., with its own factory at Lancing, Sussex. This company is continuing its work in the structural plastics field, particularly as applied to guided missiles. Yet another company, Jet Tanks Ltd., is developing a moulded plastic jettisonable fuel tank of revolutionary design.

Miles have resumed the design of electric actuators, which the original Miles company pioneered in the latter part of World War II, and are currently producing twin-motored and single-motored rotary actuators for the aircraft industry. In addition, the company has started an Electronics Division, which holds contracts for the design and manufacture of a flight refuelling simulator for R.A.F. Bomber Command, and for a fully-operational flight simulator for the de Havilland Sea Vixen naval fighter for the Royal Navy.

THE MILES M.100 STUDENT/CENTURION.

Designed and built as a private venture, the M.100 is a side-by-side two-seat light jet trainer which can be adapted easily for reconnaissance and ground support duties or as a four-seat fast communications aircraft.

The standard trainer version can be operated in the elementary training rôle with limited radio and navigational equipment, or in the basic training rôle with approximately 400 lb. (180 kg.) of additional equipment.

The prototype made its first flight on May 14, 1957 and five versions are offered for production:—

M.100 Mk. 1 Student. Similar to prototype, with one Blackburn-Turbomeca Marboré IIA turbojet (880 lb.=400 kg. s.t.).

M.100 Mk. 2 Student. Similar to Mk. 1, but with two Blackburn-Turbomeca Palas 600 turbojets (each 390 lb.=177 kg. s.t.).

M.100 Mk. 3 Centurion. Similar to Mk. 1, but with one Rolls-Royce R.B. 108 turbojet engine de-rated by approximately 30% to give unusually long overhaul life.

M.100 Mk. 4 Centurion. Similar to Mk. 3, but with one Turbomeca Gourdon turbojet engine with take-off output of 1,405 lb. (637 kg.) s.t.

M.100 Mk. 5 Centurion. Similar to Mk. 3, but with two Turbomeca Arbizon turbojet engines, each with take-off output of 550 lb. (250 kg.) s.t.

TYPE.—General-purpose Light Jet Trainer.

WINGS.—Cantilever shoulder-wing monoplane. NACA 23015 wing section. Aspect ratio 5.6. Chord 6 ft. 6 in. (1.98 m.) at root, 4 ft. 6 in. (1.37 m.) at tip. No dihedral. Incidence 2½°. Sweepback 15°. All-metal single-spar structure. All-metal slotted ailerons and flaps. Total area of ailerons 13.61 sq. ft. (1.26 m.²). Total area of flaps 17 sq. ft. (1.58 m.²). Gross wing area 144 sq. ft. (13.40 m.²).

FUSELAGE.—All-metal structure. Front fuselage built around load-carrying keel. Rear fuselage semi-monocoque. Perforated dive-brakes in fuselage sides.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. All-metal construction. Areas: fins 16.5 sq. ft. (1.53 m.²), rudders 8.5 sq. ft. (0.79 m.²), tailplane 18.5 sq. ft. (1.72 m.²), elevators 12.44 sq. ft. (1.16 m.²). Tailplane span 11 ft. 8 in. (3.55 m.).

LANDING GEAR.—Retractable tricycle type. Dowty liquid spring shock-absorbers. Pneumatic retraction. Goodyear 600 × 6 wheels. Goodyear hydraulic single-disc brakes. Wheel track 7 ft. 0 in. (2.13 m.).

POWER PLANT.—One 880 lb. (400 kg.) s.t. Blackburn-Turbomeca Marboré IIA turbojet, or two 390 lb. (177 kg.) s.t. Blackburn-Turbomeca Palas 600 turbojets, or one de-rated Rolls-Royce R.B.108 turbojet, mounted in top of fuselage aft of cabin. Fuel in four tanks in wings with total capacity of 100 Imp. gallons (455 litres) and two wing-tip tanks with total capacity of 40 Imp. gallons (182 litres). Oil capacity 1.32 Imp. gallons (6 litres).

ACCOMMODATION.—Two seats side-by-side in enclosed cabin, with two large car-type doors which are jettisonable in an emergency. Provision for lightweight ejection seats, if required. Single or dual controls.

ARMAMENT.—Provision for machine-guns, bombs and rockets for weapons training or ground support duties.

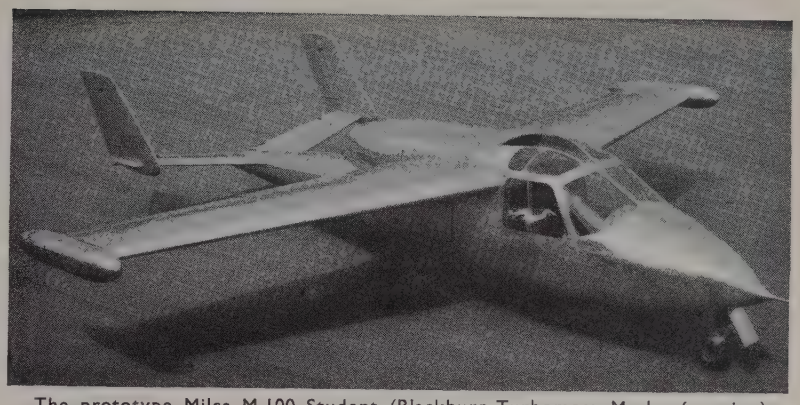
DIMENSIONS.—
Span 29 ft. 2 in. (8.90 m.).
Length 30 ft. 9 in. (9.38 m.).
Height 6 ft. 3 in. (1.90 m.).

WEIGHTS AND LOADINGS (Mk. 1 and Mk. 2).—
Weight empty, equipped 2,300 lb. (1,043 kg.).
Weight loaded (elementary training) 3,100 lb. (1,406 kg.).
Weight loaded (basic training) 3,500 lb. (1,580 kg.).
Max. loaded weight 3,600 lb. (1,630 kg.).
Max. wing loading 26 lb./sq. ft. (127 kg./m.²).
Max. power loading 4.1 lb./lb. s.t. (4.1 kg./kg. s.t.).

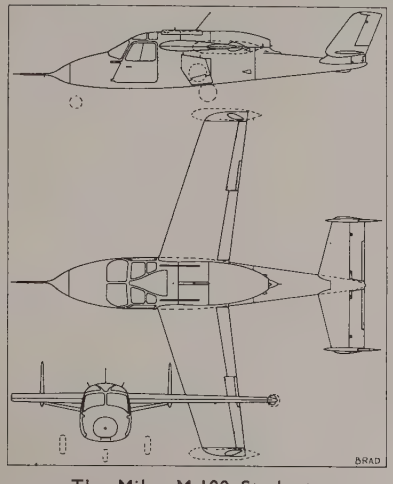
WEIGHTS AND LOADINGS (Mk. 3).—
Weight empty 2,136 lb. (968 kg.).
Fixed and removable equipment 441 lb. (200 kg.).
Weight loaded 4,000 lb. (1,814 kg.).
Wing loading 27.8 lb./sq. ft. (135 kg./m.²).
Power loading 2.9 lb./lb. s.t. (2.9 kg./kg. s.t.).

PERFORMANCE (Mk. 1 at 3,100 lb. = 1,406 kg. A.U.W., estimated).—
Max. speed at S/L. 290 m.p.h. (467 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 302 m.p.h. (486 km.h.).
Cruising speed at S/L. 254 m.p.h. (409 km.h.).
Cruising speed at 20,000 ft. (6,100 m.) 268 m.p.h. (431 km.h.).
Landing speed 69 m.p.h. (111 km.h.).
Rate of climb at S/L. 2,050 ft./min. (625 m./min.).
Time to 10,000 ft. (3,050 m.) 5.7 min.
Time to 20,000 ft. (6,100 m.) 14 min.
Take-off distance to 50 ft. (15.25 m.) 1,740 ft. (530 m.).
Landing distance from 50 ft. (15.25 m.) 1,710 ft. (520 m.).
Range with 100 Imp. gallons (455 litres) fuel in still air at 215 m.p.h. (346 km.h.) at 20,000 ft. (6,100 m.), no allowance, 476 miles (767 km.).
Max. endurance, no allowances 2 hr. 35 min.

PERFORMANCE (Mk. 3, estimated).—
Max. speed at S/L. 337 m.p.h. (540 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 351 m.p.h. (562 km.h.).



The prototype Miles M.100 Student (Blackburn-Turbomeca Marboré engine).



The Miles M.100 Student.

Cruising speed at S/L. 320 m.p.h. (512 km.h.).
Cruising speed at 20,000 ft. (6,100 m.) 328 m.p.h. (525 km.h.).
Rate of climb at S/L. 2,835 ft./min. (865 m./min.).
Time to 10,000 ft. (3,050 m.) 4.1 min.
Time to 20,000 ft. (6,100 m.) 10.3 min.
Take-off distance to 50 ft. (15.25 m.) 1,740 ft. (530 m.).
Landing distance from 50 ft. (15.25 m.) 2,190 ft. (670 m.).
Range with 140 Imp. gallons (637 litres) fuel in still air at 238 m.p.h. (382 km.h.) at 20,000 ft. (6,100 m.), no allowances, 630 miles (1,010 km.).
Max. endurance, no allowances 3 hr. 10 min.

PERFORMANCE (Mk. 4, estimated).—
Max. speed (max. cont. power) at 25,000 ft. (7,620 m.) 380 m.p.h. (612 km.h.).
Max. speed (emergency power) at 25,000 ft. (7,620 m.) 430 m.p.h. (692 km.h.).
Stalling speed (flaps down) at S/L 73 m.p.h. (117 km.h.).
Time to 10,000 ft. (3,050 m.) (emergency power) 3 min.
Time to 10,000 ft. (3,050 m.) (take-off power) 3.6 min.
Time to 10,000 ft. (3,050 m.) (max. cont. power) 4.3 min.
Time to 20,000 ft. (6,100 m.) (take-off power) 8.2 min.

PERFORMANCE (Mk. 5, estimated).—
Max. speed (max. cont. power) at 22,000 ft. (6,700 m.) 300 m.p.h. (483 km.h.).
Max. speed (take-off power) at 22,000 ft. (6,700 m.) 355 m.p.h. (571 km.h.).
Stalling speed (flaps down) at S/L 73 m.p.h. (117 km.h.).
Time to 10,000 ft. (3,050 m.) (take-off power) 5 min.
Time to 10,000 ft. (3,050 m.) (max. cont. power) 8.5 min..
Time to 20,000 ft. (6,100 m.) (take-off power) 12 min.

THE MILES HDM.105.

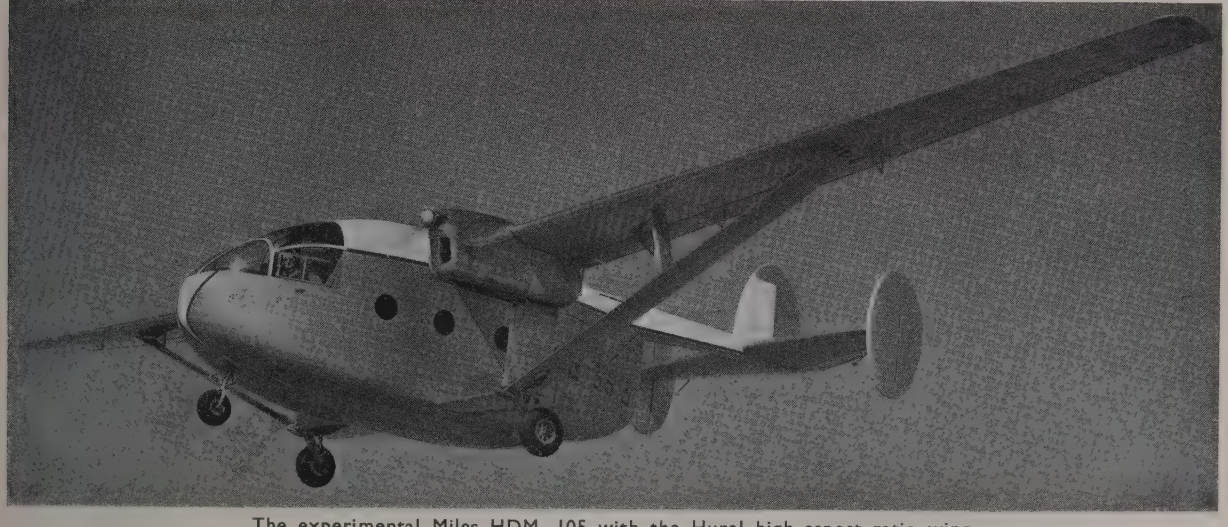
TYPE.—Twin-engined experimental monoplane.

WINGS.—High-wing strut-braced monoplane. NACA 63$_3$-420 wing section at root, NACA 63$_1$-412 wing section at tip. Aspect ratio 20.5. Chord 4 ft. 7 in. (1.39 m.) at root, 2 ft. 3½ in. (0.68 m.) at tip. Dihedral 5°. Incidence 2°. Aluminium-alloy single-spar structure. Frise type metal ailerons. Double-slotted metal and Durestos flaps. Total area of flaps 56.6 sq. ft. (5.26 m.²). Area of ailerons 22.8 sq. ft. (2.12 m.²). Gross wing area 277 sq. ft. (25.73 m.²).

FUSELAGE.—All-wood plywood-covered structure. All-metal tail-boom springing from top of rear fuselage carries tail-unit.

TAIL UNIT.—Cantilever monoplane type with three fins and rudders. All-wood plywood-covered structure. Areas: fins 23.71 sq. ft. (2.20 m.²), rudders 22.67 sq. ft. (2.11 m.²), tailplane 48.31 sq. ft. (4.49 m.²), elevators 24.0 sq. ft. (2.23 m.²). Span of tailplane 16 ft. 6 in. (5.0 m.).

LANDING GEAR.—Fixed nose-wheel type. Main wheels have articulated suspension units mounted directly to fuselage sides



The experimental Miles HDM. 105 with the Hurel high aspect ratio wing.



Another view of the Miles HDM.105 (two 155 h.p. Blackburn Cirrus Major III engines).

with Miles Airdraulic shock-absorbers. Steerable nose-wheel. Goodyear wheels size 24×7 and single-disc brakes. Wheelbase 9 ft. 6 in. (2.89 m.). Track 16 ft. 9 in. (5.10 m.).

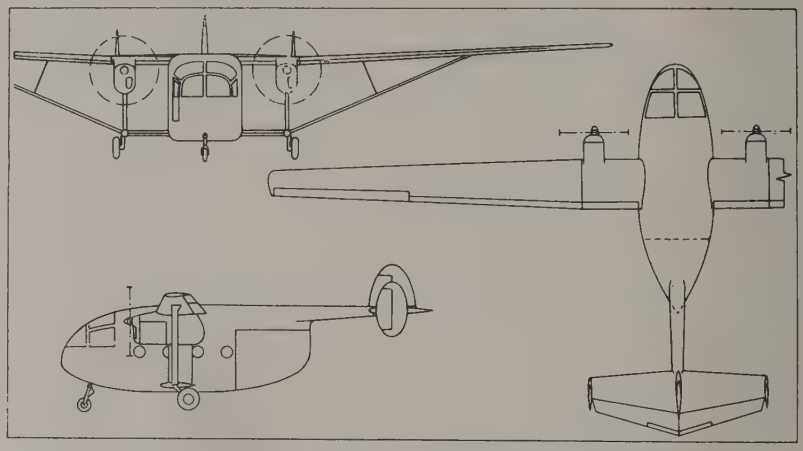
POWER PLANT.—Two 155 h.p. Blackburn Cirrus Major III four-cylinder in-line inverted air-cooled engines. Fairey fixed-pitch metal airscrews. Oil capacity 2.5 Imp. gallons (11.4 litres) for each engine.

ACCOMMODATION.—Standard Aerovan accommodation provides for crew of two in flight compartment and an unobstructed freight cabin with rear loading doors beneath tail-boom. Can also be arranged to seat up to nine passengers, with a single crew member.

DIMENSIONS.—
Span 75 ft. 4 in. (22.97 m.).
Length 34 ft. 4 in. (10.40 m.).
Height 13 ft. 11 in. (4.25 m.).

WEIGHTS.—
Weight empty 3,219 lb. (1,461 kg.).
Design loaded weight 6,060 lb. (2,750 kg.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 127 m.p.h. (204 km.h.).
Cruising speed at 3,000 ft. (915 m.) 116 m.p.h. (187 km.h.).
Initial rate of climb 657 ft./min. (200 m./min.).
Rate of climb at 1,500 ft. (460 m.) on one engine 57 ft./min. (17 m./min.).
Service ceiling 16,200 ft. (4,940 m.).
Min. T.O. run 852 ft. (260 m.).
Take-off distance to clear 50 ft. (15.25 m.) 1,932 ft. (589 m.).



The Miles HDM.105 with the Hurel high aspect ratio wing.

THE MILES HDM.106 CARAVAN.

A developed version, known as the HDM.106, has been designed and could be built comparatively easily as it uses the same wing as the HDM.105. Its all-metal fuselage would be considerably larger than that of the HDM.105, with a length of 15 ft. (4.57 m.) a minimum width of 6 ft. 3 in. (1.91 m.) and a minimum height of 6 ft. (1.83 m.) giving a total volume of 563 cub. ft. (15.94 m.³). Powered by two 290 h.p. Lycoming GO-480 or 340 h.p. Lycoming GSO-480B engines, it would have correspondingly improved performance.

THE MILES HDM.107 AEROJEEP.

The HDM.107 is a projected military light assault transport version of the HDM.106, of which a design study has been prepared at the request of the Chief of Research and Development, U.S. Army. The rear-loading fuselage, outer wings and lift struts of the two designs are identical: but a few changes have been necessitated by the planned installation of two 808 h.p. Lycoming T53 turboprop engines.

Changes include an extension of the wing centre-section span by 4 ft. 8 in. (1.42 m.) to provide airscrew clearance, increased fin area, the addition of split perforated air brakes behind the vertical wing struts and the introduction of full-span leading-edge flaps.

The greatly increased power gives a considerably improved performance, with a maximum speed at 15,000 ft. (4,570 m.) of 234 m.p.h. (377 km.h.) and minimum take-off distance of only 360 ft. (110 m.).

SAUNDERS-ROE

SAUNDERS-ROE, LIMITED.

HEAD OFFICE: OSBORNE, EAST COWES, ISLE OF WIGHT.

WORKS: EAST COWES, ISLE OF WIGHT, AND AT SOUTHAMPTON AIRPORT, EASTLEIGH, HANTS.

HELICOPTER DIVISION: SOUTHAMPTON AIRPORT, EASTLEIGH, HANTS.

President: Sir Alliott Verdon-Roe, O.B.E., Hon. F.R.Ae.S., M.I.Ae.E.

Directors: The Hon. H. N. Morgan-Grenville, O.B.E. (Chairman), Sir Arthur Gouge, B.Sc., F.R.Ae.S., M.I.Mech.E. (Vice-Chairman), Captain E. D. Clarke, C.B.E., M.C. (Managing Director), W. Browning, F.R.Ae.S., A.M.I.Mech.E., M.I.P.E. (General Manager), F. E. N. St. Barbe and P. D. Irons, B.Com., A.C.A., F.C.W.A. (Secretary).

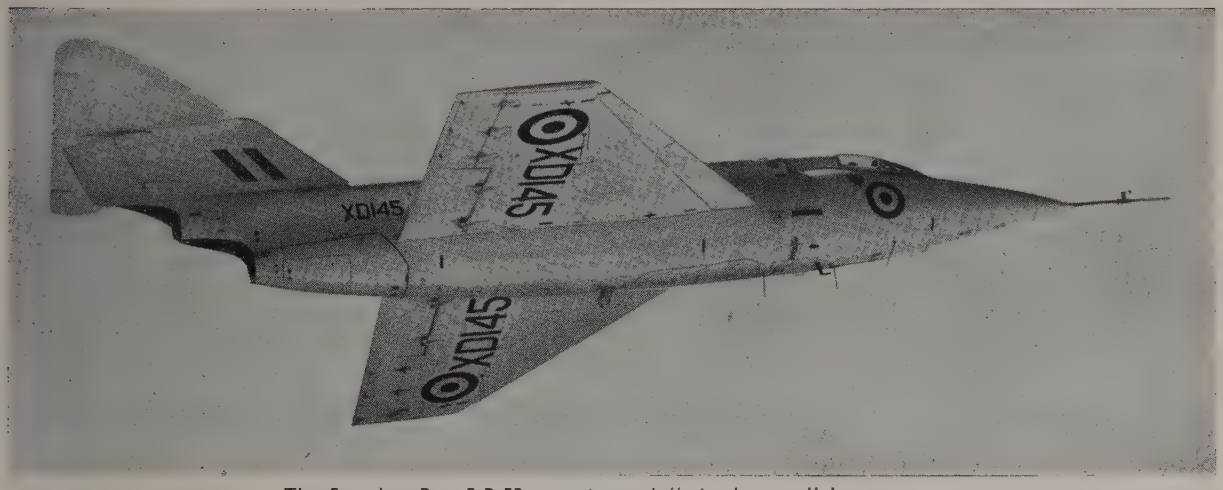
Chief Designer: M. J. Brennan, B.Sc., A.M.I.Mech.E., F.R.Ae.S.

Chief Engineer, Helicopter Division: T. L. Ciastula, Dipl.-Ing., A.M.I.Mech.E., A.F.R.Ae.S.

Saunders-Roe have specialised in the design and construction of flying-boats



The Saunders-Roe S-R.53 experimental "mixed-power" Interceptor.



The Saunders-Roe S-R.53 experimental "mixed-power" Interceptor.

over many years, and present research programmes include the development of water-based aircraft for operation in open ocean conditions.

Post-war activities have included development of the S-R.A1 experimental jet fighter flying-boat and the 345,000 lb. Princess flying-boat, powered by ten Proteus turboprop engines.

The first Princess flew on August 22, 1952, and completed extensive and successful flight trials before the decision was taken in 1954 to suspend further development until more suitable engines than the Proteus 600 Series became available. Together with the airframes of the second and third aircraft, it is now Cocooned, pending a decision as to its future.

A full description of the Princess has appeared in earlier editions of this work.

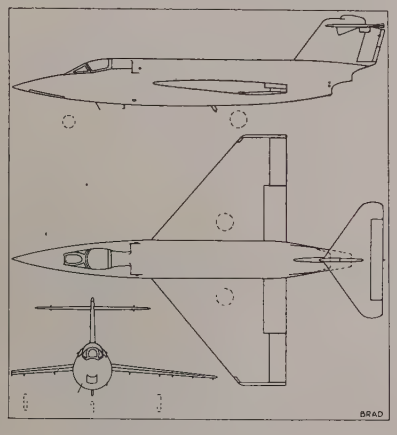
In 1956 it was announced that the company was engaged in the development and construction of a mixed-unit (jet/rocket) interceptor under the designation S-R.53, and this aircraft has now flown.

The Saunders-Roe Helicopter Division was formed on January 22, 1951, when the company took over the premises, current design commitments and technical staff of the Cierva Autogiro Co., Ltd.

In 1956 de Havilland Holdings Limited acquired an interest in Saunders-Roe, Limited.

THE SAUNDERS-ROE S-R.53.

The S-R.53, the first British manned aircraft to employ the "mixed-power" formula, was built under a Ministry of Supply contract as an experimental interceptor. The first of two prototypes made its maiden flight on May 16, 1957.



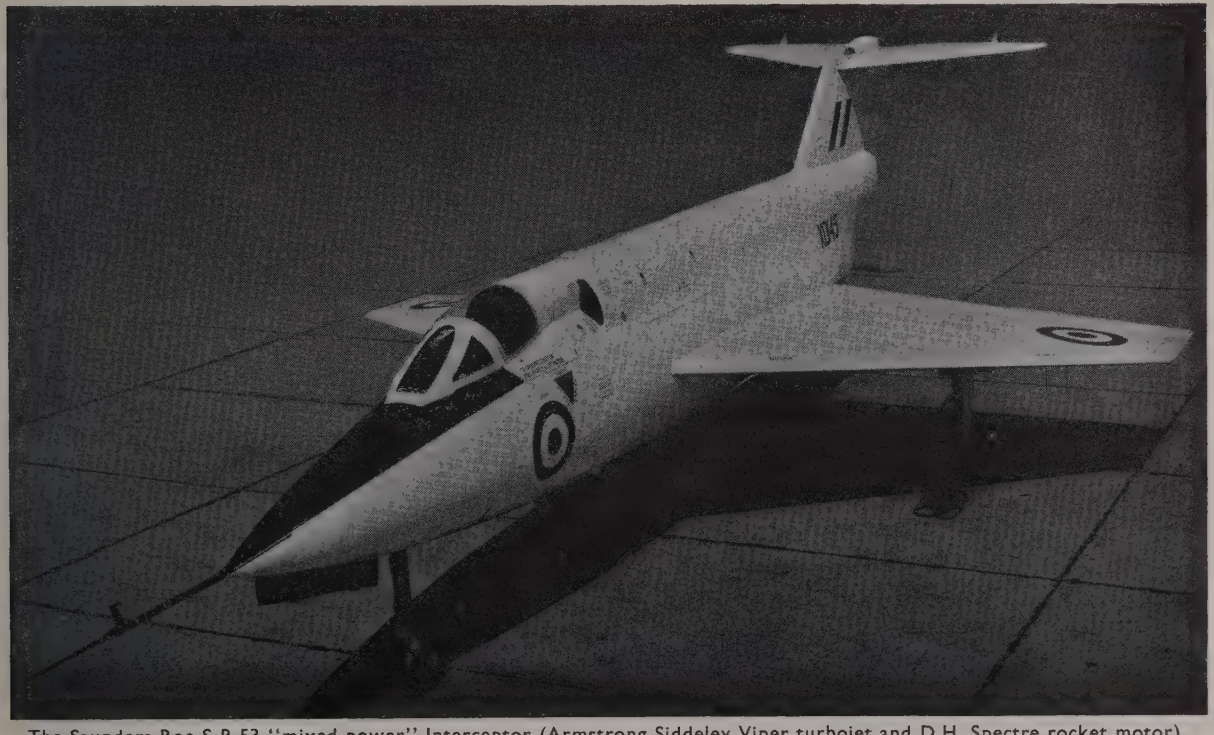
The Saunders-Roe S-R.53.

The S-R.53 is a conventional delta-wing monoplane with an all-moving delta tail-unit mounted at the top of the fin. The mixed power-unit consists of a de Havilland Spectre variable-thrust long-life rocket motor and an Armstrong Siddeley Viper turbojet engine, the latter being mounted in the centre section of the fuselage, with the Spectre located in the rear fuselage beneath the Viper's tailpipe. Two small air intakes for the Viper are located behind the cockpit canopy, one on each side. Both units use kerosene with high test peroxide serving as the oxidant for the rocket motor.

Armament of the S-R.53 consists of two de Havilland Firestreak air-to-air guided weapons carried at the tips of the wings, which are fitted with full-span leading-edge flaps.

DIMENSIONS.—
Span 25 ft. 1¼ in. (7.65 m.).
Length 45 ft. 10 in. (13.72 m.).
Height 10 ft. 10 in. (3.29 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Saunders-Roe S-R.53 "mixed-power" Interceptor (Armstrong Siddeley Viper turbojet and D.H. Spectre rocket motor).

THE SAUNDERS-ROE P.177.

Saunders-Roe are reported to be building under the designation of P.177 a developed interceptor version of the S-R.53 mixed-power unit aircraft, with a de Havilland Spectre rocket motor and a de Havilland Gyron Junior turbojet engine. No details are available.

THE SAUNDERS-ROE SKEETER.

The Skeeter was originally designed and built by the Cierva Autogiro Company, Ltd. before that company was taken over by Saunders-Roe in 1951. Saunders-Roe have continued its development, primarily as a military helicopter, up to the Series 7 stage, which is the current production version.

The Series 6 (Mks. 10 and 11) and 7 (Mks. 12 and 13) have been adopted for service in the Royal Air Force, the British Army, and the Army and Navy of the Federal German Republic. The British military versions have the following official designations:—

Skeeter A.O.P. Mk. 10. Air observation post, ordered for service with the Army Air Corps.

Skeeter T. Mk. 11. Training version for R.A.F.

Skeeter A.O.P. Mk. 12. Similar to Mk. 10 but powered by the 215 h.p. D.H. Gipsy Major 215 engine. In production for British Army, and the Army and Navy of the German Federal Republic.

Skeeter T. Mk. 13. Similar to T. Mk. 11 but with 215 h.p. D.H. Gipsy Major 215 engine. In production for R.A.F.

TYPE.—Two-seat light helicopter.

ROTOR SYSTEM.—Three-blade main rotor, fully-articulated hub with drag and flapping hinges. Rotor blades have steel tubular spars, wood ribs and wood and fabric skin. One two-blade anti-torque and steering rotor with solid wood blades. Main rotor blade area 11.95 sq. ft. (1.11 m.²). Main rotor disc area 804 sq. ft. (74.69 m.²). Anti-torque rotor disc area 25 sq. ft. (2.32 m.²).

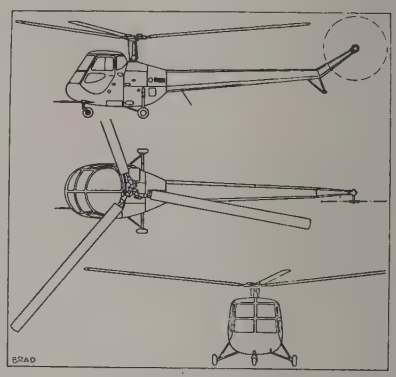
FUSELAGE.—Steel tubular centre-section, sheet metal fabricated front fuselage, sheet metal monocoque tail boom.

LANDING GEAR.—Tricycle type. Saunders-Roe oleo-spring shock-absorbers. Palmer wheels and tyres. Wheelbase 5 ft. 1 in. (1.55 m.). Track 7 ft. (2.13 m.).

POWER PLANT.—One 200 h.p. (Series 6) or 215 h.p. (Series 7) de Havilland Gipsy Major four-cylinder inverted air-cooled engine mounted athwartships in fuselage centre-section immediately aft of cabin fireproof bulkhead. Transmission for main rotor through spur reduction gear to intermediate shaft driving final bevel. Tail rotor driven off same intermediate shaft through free-wheel and manually-operated clutch. Main rotor/engine r.p.m. ratio 1 : 7.74. Anti-torque rotor/engine r.p.m. ratio 1 : 1.47. Fuel tank in fuselage forward of fireproof bulkhead. Fuel capacity 23 Imp. gallons (105 litres). Oil tank capacity 3 Imp. gallons (13.5 litres).



The Saunders-Roe Skeeter Mk. 10 Military Helicopter (200 h.p. D.H. Gipsy Major 200 engine).



The Saunders-Roe Skeeter.

ACCOMMODATION.—Cabin seats two side-by-side. Entrance door on each side. Observer's seat reversible in military version. Provision for two stretchers, mounted externally on sides of cabin.

DIMENSIONS.—
Main rotor diameter 32 ft. (9.76 m.).
Overall length (blades folded) 28 ft. 5 in. (8.66 m.).
Length of fuselage 26 ft. 6 in. (8.10 m.).
Overall width (blades folded) 7 ft. 4½ in. (2.25 m.).
Height over main rotor head 7 ft. 6 in. (2.29 m.).
Tail rotor diameter 6 ft. (1.83 m.).

WEIGHTS (Series 6).—
Tare weight 1,626 lb. (738 kg.).
Disposable load 574 lb. (260 kg.).
Normal all-up weight 2,150 lb. (980 kg.).
Max. all-up weight 2,200 lb. (1,000 kg.).

WEIGHTS (Series 7).—
Weight loaded (normal) 2,200 lb. (998 kg.).
Weight loaded (supercharged engine) 2,250 lb. (1,020 kg.).

PERFORMANCE (Series 6—I.S.A. conditions at normal A.U.W.).—
Max. forward speed at S/L. 106 m.p.h. (172 km.h.).
Max. cruising speed at S/L. 104 m.p.h. (168 km.h.).
Vertical rate of climb at S/L. 230 ft./min. (70 m./min.).
Max. rate of climb 1,020 ft./min. (310 m./min.).
Hovering ceiling (free air) 1,100 ft. (335.5 m.).
Min. rate of descent (engine off) 1,350 ft./min. (412 m./min.).
Service ceiling 11,700 ft. (3,560 m.).
Absolute ceiling 12,900 ft. (3,930 m.).



The Saunders-Roe Skeeter with Napier blade-tip rocket booster system.



The Saunders-Roe Skeeter equipped as an Ambulance.

Max. endurance at 52 m.p.h. (83 km.h.) at S/L. 3.3 hours.
Max. range at 86 m.p.h. (136 km.h.) at S/L. 238 miles (382 km.).
PERFORMANCE (Series 7, normal).—
Max. speed 104 m.p.h. (167 km.h.).
Max. cruising speed 101 m.p.h. (163 km.h.).
Vertical rate of climb at S/L 425 ft./min. (130 m./min.).
Max. rate of climb with forward speed of 52 m.p.h. (84 km.h.). 1,150 ft./min. (350 m./min.).
Service ceiling 12,800 ft. (3,900 m.).
Hovering ceiling in ground effect 5,500 ft. (1,680 m.).
Hovering ceiling out of ground effect 2,500 ft. (762 m.).
Max. range 213 miles (342 km.).
Max. endurance 3 hours.
PERFORMANCE (Series 7, supercharged engine).—
Max. speed 102.5 m.p.h. (165 km.h.).
Max. cruising speed 100 m.p.h. (161 km.h.).
Vertical rate of climb at S/L 310 ft./min. (95 m./min.).
Max. rate of climb with forward speed of 52 m.p.h. (84 km.h.) 1,100 ft./min. (335 m./min.).
Service ceiling 16,700 ft. (5,100 m.).
Hovering ceiling in ground effect 10,400 ft. (3,175 m.).
Hovering ceiling out of ground effect 7,800 ft. (2,380 m.).
Max. range 190 miles (305 km.).
Max. endurance 2.7 hours.

In conjunction with D. Napier & Son, Ltd., Saunders-Roe have applied a rocket booster system to the Skeeter to provide additional emergency power for short periods.

The booster system provides thrust at the rotor tips so that no additional torque is imposed on the existing transmission system. The rotor speed is not increased, the power being absorbed in greater lift on the rotor blades.

The fuel, high-test peroxide, is stored in a tank mounted above the rotor hub and is pumped to the Napier rocket motors by the centrifugal action of the rotor blades. On entering the rocket motors the liquid peroxide is decomposed into superheated steam and oxygen by a catalyst. The generated gases then pass to a nozzle at the tip of each rotor blade which causes the gases to be ejected at high velocity to provide thrust reaction.

With rocket booster the Skeeter Mk. 6 at normal A.U.W. of 2,150 lb. (980 kg.) has the following performance :—

Vertical rate of climb at S/L. 1,400 ft./min. (427 m./min.).
Hovering ceiling (free air) 8,500 ft. (2,592 m.).
Rate of climb at S/L. 1,800 ft./min. (550 m./min.).
Min. rate of descent (piston engine off) 650 ft./min. (198 m./min.).
Max. forward speed at S/L. 115 m.p.h. (184 km.h.).

SCOTTISH AVIATION
SCOTTISH AVIATION, LTD.

HEAD OFFICE AND WORKS: PRESTWICK AIRPORT, AYRSHIRE.
LONDON OFFICE: 25, COCKSPUR ST., S.W.1.

Directors: The Duke of Hamilton, P.C., G.C.V.O., A.F.C., F.R.G.S. (Chairman), D. F. McIntyre, A.F.C. (Managing Director), T. D. M. Robertson (General Manager), R. McIntyre, A.F.R.Ae.S. (Chief Engineer), Sir Jackson Millar and H. W. Fulton.

Scottish Aviation Ltd. was formed in 1935 to provide opportunities for employment in the various branches of aviation in Scotland. In doing so, the company has developed the International Airport at Prestwick and on it has established an aircraft design and manufacturing industry.

The company's five-seat Prestwick Pioneer first flew in 1950 and its use by the Royal Air Force, particularly in the jungle territory of Malaya, has demonstrated its possibilities for transport support in hitherto inaccessible regions.

The Pioneer has been followed by a twin-engined version carrying a crew of two and sixteen passengers and known as the Twin Pioneer. This aircraft received a full normal category Certificate of Airworthiness on November 16, 1956, and is in quantity production. An unspecified number of Twin Pioneers has been ordered for the Royal Air Force.

It has been announced that Scottish Aviation is "to undertake new projects associated with long-range weapons in South Australia."

THE TWIN PIONEER.

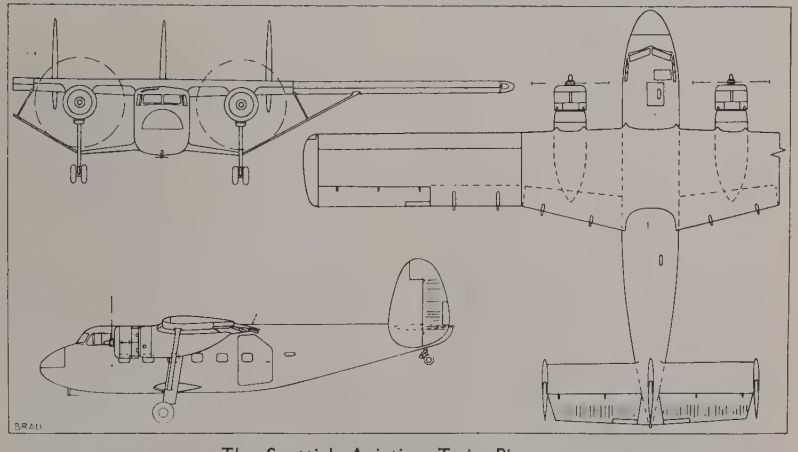
The Twin Pioneer is a 16-passenger light transport, which uses standard Pioneer wings attached outboard of a new wing centre-section. The prototype first flew on June 25, 1955, and the first production Twin Pioneer flew on April 28, 1956. An unspecified number of Twin Pioneers have been ordered for the Royal Air Force. Other firm orders include one for Rio-Tinto Corp. for aerial surveys; three for de Kroonduif, the Dutch New Guinea associate of K.L.M.; one for the Zinc Corp. of Australia; two for Kuwait Oil; three for the Royal Iran Flying Club; one for the Austrian Government; and two jointly for the Governments of Sarawak, North Borneo and Brunei.

In addition, Philippine Air Lines have ordered five Twin Pioneers powered by Pratt & Whitney R-1340 Wasp engines, the change in power plant requiring little modification to the aircraft.

The following data refer to the standard version with Leonides engines.

TYPE. –Twin-engined Transport designed for operation from small landing fields.

WINGS.—High-wing braced monoplane. NACA 4415 wing section. Aspect ratio 8.74. Chord, root 12 ft. 8½ in. (3.87 m.), tip 7 ft. 11 in. (2.41 m.). Dihedral 1° 58' on centre section, 3° on outer wings. Incidence 4°. Two-spar light alloy stressed skin structure. Fowler type light alloy



The Scottish Aviation Twin Pioneer.



The Scottish Aviation Military Twin Pioneer (two 540 h.p. Alvis Leonides engines).

flaps and hydraulically-operated slats on leading edge. Slotted ailerons have light alloy frames and fluted metal skin. Total area of flaps 104.4 sq. ft. (9.70 m.²). Total aileron area 47.6 sq. ft. (4.42 m.²). Gross wing area 670 sq. ft. (62.24 m.²).

FUSELAGE.—Light alloy stressed-skin semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Light alloy stressed-skin structure with fluted skin on control surfaces to give improved strength/weight ratio. Port and starboard elevators interchangeable. Areas: fins 106.6 sq. ft. (9.90 m.²), rudders 60.7 sq. ft. (5.64 m.²), tailplane 115.3 sq. ft. (10.71 m.²), elevator 51.9 sq. ft. (4.82 m.²). Tailplane span: 25 ft. (7.62 m.).

LANDING GEAR.—Fixed tail-wheel type. Electro Hydraulics, Ltd. oleo-pneumatic shock-absorber struts. Twin wheels on main units. Dunlop wheels with three-cylinder single-plate caliper hydraulic brakes. Track 18 ft. 6 in. (5.63 m.). Wheelbase 28 ft. (8.53 m.).

POWER PLANT.—Two 520/540 h.p. Alvis Leonides 514/8 radial air-cooled engines. D.H. PD 205/323/1 3-blade feathering constant-speed airscrews. Two 90 Imp. gallon (409 litres) and two 33.5 Imp. gallon (152.25 litres) tanks in wings. Total fuel capacity (civil) 247 Imp. gallons (1,122.5 litres). Military version has normal tankage of 371 Imp. gallons (1,687 litres) in wings, and can also carry one or two 100 Imp. gallon (455 litre) ferry tanks in cabin. One 9 Imp. gallon (41 litre) oil tank in each engine nacelle.

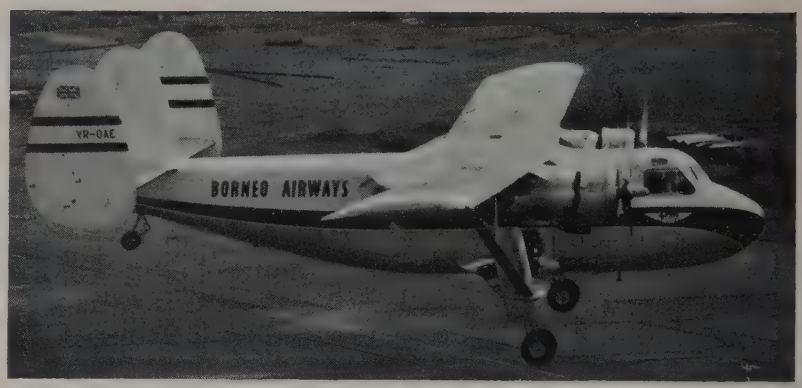
ACCOMMODATION (Civil).—Pilot and co-pilot or radio-operator and sixteen passengers. Large freight loading and passenger entry door on port side.

ACCOMMODATION (Military).—Similar to civil version, but equipped also for ambulance rôle with 12 litters, supply-dropping rôle with up to 3,400 lb. (1,540 kg.) of cargo, or bombing rôle with up to 2,000 lb. (907 kg.) of H.E. or anti-personnel bombs under sponsons. Bomb-aimer's prone position is in main cabin.

DIMENSIONS.—
Span 76 ft. 6 in. (23.33 m.).
Length 45 ft. 3 in. (13.80 m.).
Height 13 ft. 3 in. (4.04 m.).

WEIGHTS AND LOADING.—
Weight empty 9,500 lb. (4,310 kg.).
Disposable load 3,700 lb. (1,678 kg.).
Weight loaded 13,500 lb. (6,124 kg.).
Wing loading 20.13 lb./sq. ft. (98.28 kg./m.²).

PERFORMANCE (Civil).—
Max. speed at 1,450 ft. (440 m.) 165 m.p.h. (265 km.h.).
Max. continuous cruising speed at 3,400 ft. (1,035 m.) 163 m.p.h. (262 km.h.).
Stalling speed 60 m.p.h. (96 km.h.).



The Scottish Aviation Twin Pioneer in the colours of Borneo Airways.

Service ceiling 18,800 ft. (5,660 m.).
Take-off distance to 50 ft. (15.25 m.) 1,017 ft. (310 m.).
Landing distance from 50 ft. (15.25 m.) 1,170 ft. (357 m.).
Range at cruising speed of 119 m.p.h. (191 km.h.) at 5,000 ft. (1,525 m.) 916 miles (1,475 km.).

THE PRESTWICK PIONEER.

The prototype of the Leonides-powered Prestwick Pioneer flew on May 5, 1950, and the first production model on June 25, 1953. This version is in service with the Royal Air Force as the Pioneer C.C. Mk. 1.

TYPE.—Five-seat light Transport, designed for operation from small landing fields.

WINGS.—High-wing strut-braced monoplane. Constant chord wing of NACA 4415 section fitted with hydraulically-operated full-span slats and 57.5% span Fowler and split flaps. For take-off, leading-edge slat is open and Fowler flap setting 20°. For landing, the Fowler flap lowers to 30°. Aspect ratio 6.38. Chord 7 ft. 11 in. (2.41 m.). The dihedral angle is 1° and incidence 4°. Wings of aluminium-alloy all-metal, two-spar stressed-skin construction. Wings braced to fuselage by single strut on each side. Fowler flap and slat run in tracks of extruded I-section light alloy and are operated by a system of cables from single jack located in port wing. Slotted ailerons are of aluminium-alloy construction with fabric covering. Aluminium-alloy flaps and slats are interchangeable port and starboard. Aileron area 30 sq. ft. (2.79 m.²). Fowler flap area 67.7 sq. ft. (6.29 m.²). Gross wing area 390 sq. ft. (36.2 m.²).

FUSELAGE.—Mainly aluminium-alloy semi-monocoque stressed-skin construction of basically oval cross-section, but with high-tensile steel-tube structure in region of wing centre-section.

TAIL UNIT.—Cantilever monoplane type, but with short additional support struts to front spar of tailplane. Construction of tailplane and fin is similar to that of wing. Rudder and elevators are metal with fabric covering, port and starboard elevators being interchangeable. The tailplane is electrically actuated, its incidence being adjustable in flight over a range from +4° to −9°. Areas: fin 16.32 sq. ft. (1.52 m.²), rudder 14.58 sq. ft. (1.35 m.²), elevators 38.2 sq. ft. (3.55 m.²), tailplane 46.3 sq. ft. (4.3 m.²). Tailplane span 18 ft. 8 in. (5.69 m.).

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock-absorber struts made by J. McDonald & Co. Goodyear wheels and three-cylinder, single-plate, caliper hydraulic wheel-brakes. Track 9 ft. 6 in. (2.9 m.). Wheelbase 21 ft. 7 in. (6.58 m.).

POWER PLANT.—One 520/540 h.p. Alvis Leonides 502/7 radial air-cooled engine, supplied as a complete power-plant unit. D.H. Type D.183/313/1 three-blade feathering constant-speed airscrew. Fuel in four tanks, two in each wing, with a total capacity of 128 Imp. gallons (582 litres). Oil capacity 4.5 Imp. gallons (20.5 litres).

ACCOMMODATION.—Enclosed cabin seating five in a one-two-two arrangement with the pilot's seat forward on the centre line. The back of the pilot's seat hinges rearwards to facilitate entry and exit. Seats and harness stressed to withstand a deceleration of 25 g. All seats are readily removable and the cabin can be arranged to carry one stretcher and attendant. Latest models have a stretcher hatch on the port side of the fuselage to facilitate casualty loading.

DIMENSIONS.—
Span 49 ft. 9 in. (15.17 m.).
Length 34 ft. 4¾ in. (10.49 m.).
Height (tail down) 11 ft. 4⅝ in. (3.47 m.).

WEIGHTS AND LOADINGS.—
Weight empty 4,230 lb. (1,920 kg.).
Disposable load 1,570 lb. (713 kg.).
Weight loaded 5,800 lb. (2,630 kg.).
Wing loading at take-off 14.9 lb./sq. ft. (72.7 kg./m.²).
Power loading at take-off 10.38 lb./h.p. (4.7 kg./h.p.).

PERFORMANCE.—
Max. speed at 1,500 ft. (460 m.) 145 m.p.h. (234 km.h.).
Max. continuous cruising speed at 6,700 ft. (2,040 m.) 142 m.p.h. (228 km.h.).
Stalling speed 43 m.p.h. (69 km.h.).
Service ceiling 15,850 ft. (4,830 m.).
Range at 115 m.p.h. (185 km.h.) at 5,000 ft. (1,525 m.) 805 miles (1,297 km.).
Take-off distance to 50 ft. (15.2 m.) 800 ft. (245 m.).
Landing distance from 50 ft. (15.2 m.) 900 ft. (275 m.).



The Pioneer C.C. Mk. 1, the R.A.F. version of the Prestwick Pioneer.

SHORT

SHORT BROTHERS & HARLAND, LTD.

HEAD OFFICE, WORKS AND AERODROME: QUEEN'S ISLAND, BELFAST, N. IRELAND.

OTHER FACTORIES: NEWTOWNARDS (2), CASTLEREAGH, BELFAST (2), ROCHESTER, LISBURN AND BALLYCLARE.

LONDON OFFICE: 17, GROSVENOR STREET, W.1.

Honorary Life President: H. O. Short, F.R.Ae.S.

Directors: Rear-Admiral Sir Matthew S. Slattery, C.B., D.Sc., F.R.Ae.S. (Chairman and Managing Director); J. S. Baillie; Sir James H. Barnes, K.C.B., K.B.E., M.A.; Sir Sam H. Brown; H. G. Conway, M.A., M.I.Mech.E., F.R.Ae.S.; R. E. Harvey; D. Keith-Lucas, B.A., M.I.Mech.E., F.R.Ae.S.; J. Lankester Parker, O.B.E., F.R.Ae.S.; Sir Frederick E. Rebbeck, K.B.E., D.Sc., D.L., J.P.; Sir Reginald Verdon Smith, M.A., B.C.L., J.P.; C. F. Uwins, O.B.E., A.F.C., F.R.Ae.S.

Secretary: E. W. A. Woolmer, B.A., C.A.

The first manufacturers of aircraft in the United Kingdom, the original firm of Short Brothers was established at Leysdown in 1909, with a contract to build six Wright biplanes.

The brothers Short quickly gained a wide reputation and many naval aircraft of their design and manufacture flew in the 1914-18 war. After the war, the company pioneered all-metal construction



The Short S.C.1 experimental VTOL Monoplane (five Rolls-Royce RB.108 turbojet engines).

and concentrated on the development of water-based aircraft at its works, which had been moved to Rochester.

In June, 1936, Short Brothers, in collaboration with Harland & Wolff, Ltd. the well-known shipbuilders, formed a new company known as Short & Harland, Ltd. to build aircraft in Belfast.

In September, 1947, as a result of Government policy, the company's major works at Rochester were closed and all its activities were concentrated at Belfast. Consequently the Rochester company, Short Brothers (Rochester & Bedford) Ltd., and the Belfast company were merged to form Short Brothers and Harland Ltd. of Belfast.

An important current product of this company is the S.C.1 vertical take-off and landing research aircraft, which is being developed for the Ministry of Supply.

Shorts are also building the English Electric Canberra jet bomber under direct contract from the Ministry of Supply, and the Britannia turboprop airliner, under an agreement with the Bristol Company. The first Short-built Britannia—a Series 300 aircraft for Northeast Airlines of America—flew on June 1, 1957.

In 1954 the Bristol Aeroplane Co., Ltd. acquired a small financial interest in Short Brothers & Harland, Ltd. and two directors of the Bristol company were invited to join the Board.

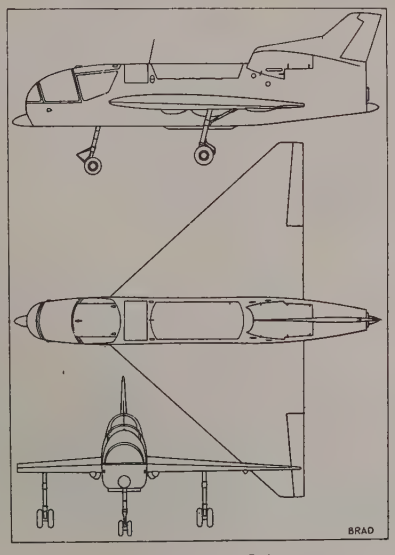
THE SHORT S.C.1.

The S.C.1 (originally known as the P.D.11) is an experimental delta-wing aircraft designed for research in the field of vertical take-off and landing. It is the first fixed-wing VTOL aeroplane to be built in Britain and, when its development programme is completed, will be capable of unrestricted vertical ascent and descent, and transition from hovering to forward flight.

The S.C.1 carried out taxi-ing trials in December, 1956 and made its first flight at Boscombe Down on April 2, 1957, using normal take-off technique. This flight marked the beginning of a series of tests—including hovering trials in a specially-built gantry at Belfast—which were expected to continue for some time before the aircraft made its first free vertical take-off.

The S.C.1 was designed and built under contract from the Ministry of Supply. Short Brothers & Harland are handling all development work on the aircraft, including the auto-stabiliser and control systems, which were developed in conjunction with the Royal Aircraft Establishment.

The main undercarriage wheels of the aircraft are capable of castoring through 360°, and it is powered by five Rolls-Royce RB 108 engines, of which four are believed to be used to provide vertical



The Short S.C.1.

jet thrust for take-off and landing, and the other for normal horizontal thrust in cruising flight. Details of its engine installation and performance are not yet available.

THE SHORT S.B.5.

The S.B.5 is a research aircraft which was designed and built at the request of the Ministry of Supply for the investigation of problems associated with the low-speed handling characteristics of swept-back wings.

The S.B.5 was designed so that varying degrees of sweepback can be tested. The tailplane can also be positioned either at the extreme top of the fin or beneath the rear fuselage and its angle of incidence is variable.

The varying degrees of sweep-back angle are achieved by fitting alternative components and four configurations can be tested. These are 50° wing sweepback with high tail-unit; 60° sweepback with low tail-unit; 60° sweepback with high tail-unit; and 69° sweepback with high tail-unit. The angle of incidence of the tailplane can be varied in flight from 10° above to 10° below the horizontal. The position of the non-retracting nose-wheel landing-gear can be changed to enable each configuration to be tested at various C.G. positions.

The S.B.5 has completed a series of tests with 50° and 60° sweepback—in the latter configuration with both high and low set tailplane—while powered by a Rolls-Royce Derwent turbojet engine. In 1958 it is to be re-engined with a Bristol Orpheus turbojet prior to testing



The Short S.B.5 with 60° wing sweepback and high tail.

the 69° sweepback configuration. It is mainly of all-metal construction, the leading and trailing-edges of the wings being plywood-covered. The pilot's cockpit, which is forward of the wings, is provided with an ejector seat. Anti-spin and braking parachutes are fitted.

The S.B.5 was responsible for all the low-speed research carried out in the development of the English Electric P.1 fighter.

DIMENSIONS.—
Span (50° configuration) 35 ft. 2¼ in. (10.74 m.).
Span (60° configuration) 30 ft. 6 in. (9.30 m.).
Span (69° configuration) 25 ft. 11¾ in. (7.92 m.).
Overall length 47 ft. 4 in. (14.43 m.).
Max. Height (high tailplane) 16 ft. 7 in. (5.0 m.).
Max. height (low tailplane) 15 ft. (4.57 m.).

SLINGSBY

SLINGSBY SAILPLANES, LTD.

HEAD OFFICE AND WORKS: KIRBYMOORSIDE, YORKSHIRE.

Directors: F. N. Slingsby, M.M., A.F.R.Ae.S. (Managing), Lieut-Col. G. R. D. Shaw, G. E. Shaw, G. Dixon, J. R. H. Shaw.

THE SLINGSBY TYPE 45.

Intended to meet the need for a moderately-priced sailplane, with a good performance for club and private owner use, the Type 45 is a single-seater with a span of 40 ft. (12 m.). It has a laminar-flow wing, and fuselage of simple construction with a slab-sided rear section.

The prototype was scheduled to fly in the autumn of 1957.

THE SLINGSBY TYPE 42 EAGLE 3.

The Type 42 high-performance two-seat sailplane first flew in prototype form in June, 1954. The first production Type 42 followed in April, 1956 and won the two-seater class at the 1956 International Gliding Contests in France.

TYPE.—High-performance two-seat Sailplane.

WINGS.—High-wing cantilever monoplane. Wing sections NACA 63$_3$618 at root, NACA 4412 at tip. Aspect ratio 14.8 to 1. Chord 60 in. (1.52 m.) at root, 28.5 in. (0.72 m.) at tip. Dihedral 2° on outer wings. Incidence 5° at root. All wood structure comprising main spar and light rear spar. Plywood covering to rear spar. Fabric-covered trailing-edge. Plain plywood-covered ailerons. Gross wing area 229 sq. ft. (21.3 m.^{2}).

FUSELAGE.—Braced girder wooden construction. Nose covered with fibre-glass and plywood. Rear fuselage fabric-covered.

TAIL UNIT.—Cantilever monoplane type. All-wood framework with plywood-covered fin and tailplane, fabric-covered rudder and elevator. Areas: fin 11.8 sq. ft. (1.09 m.^{2}), rudder 9.8 sq. ft. (.91 m.^{2}) tailplane 25.56 sq. ft. (2.37 m.^{2}), elevator 15 sq. ft. (1.39 m.^{2}). Tailplane span 12 ft. 2 in. (3.70 m.).

LANDING GEAR.—Mono-wheel type, with single landing wheel terminating a single centrally-placed skid under forward fuselage. Tailskid at base of fin.

ACCOMMODATION.—Tandem cockpit forward of wing, with transparent canopy. Provision for back-type parachutes.

DIMENSIONS.—
Span 58 ft. 3 in. (17.75 m.).
Length 27 ft. 11 in. (8.5 m.).
Height 6 ft. (1.83 m.).

WEIGHTS.—
Weight empty 700 lb. (318 kg.).
Weight loaded 1,200 lb. (545 kg.).

PERFORMANCE.—
Best glide ratio 31 : 1 at 49.5 m.p.h. (79.7 km.h.).
Min. sink speed 2 ft./sec. (0.61 m./sec.) at 49 m.p.h. (78.7 km.h.).
Speed at sink of 6 ft./sec. (1.83 m./sec.) 79 m.p.h. (128 km.h.).
Min. speed at max. weight 36.5 m.p.h. (58.7 km.h.).

THE SLINGSBY TYPE 34 SKY.

The Type 34 high-performance sailplane was specially designed to make an all-British design available for national and international gliding contests.



The Slingsby Type 34 Sky Single-seat Sailplane.



The Slingsby Type 42 Eagle 3 two-seat Sailplane.

In the 1952 International Gliding Championships, the British team won first and third places in the single-seat class flying Sky sailplanes. Other nations flying the Sky in that contest were the Argentine Republic and Holland.

TYPE.—High-performance contest sailplane.

WINGS.—High-wing cantilever monoplane. Single-spar, torsion-resisting nose-box structure with light secondary spar to carry two-piece ailerons. Wood construction. Fabric covered aft of main spar. D.F.S.-type dive brakes. Gross wing area 187 sq. ft. (17.4 m.^{2}). Standard mean chord 3.165 ft. (0.96 m.). Aspect ratio 18.65 : 1.

FUSELAGE.—Ply-covered stressed-skin structure.

TAIL UNIT.—Cantilever tailplane. Fabric covered rudder and elevator. Span 9.9 ft. (3.01 m.).

LANDING GEAR.—Mono-wheel type, with single landing wheel terminating a single centrally-placed ash skid beneath forward fuselage. Alternatively, a jettisonable two-wheel dolly may be used. Ash tail skid.

ACCOMMODATION. — Single-seat cockpit immediately forward of wing leading-edge, with one-piece moulded Perspex canopy.

DIMENSIONS.—
Span 59 ft. 1 in. (18 m.).
Length 24 ft. 10½ in. (7.585 m.).

WEIGHTS AND LOADINGS.—
Empty weight 549.5 lb. (250 kg.).
Disposable load 250 lb. (113.5 kg.).
All-up weight 800 lb. (364 kg.).
Wing loading 4.29 lb./sq. ft. (21 kg./m.^{2}).

PERFORMANCE.—
Sinking speed at 39 m.p.h. (62.9 km.h.) 2 ft./sec. (0.61 m./sec.).
Gliding angle at 46 m.p.h. (74 km.h.) 1 in 30.

THE SLINGSBY TYPE 41 SKYLARK 2.

TYPE.—Single-seat Sailplane.

WINGS.—High-wing cantilever monoplane. Wing sections NACA 63$_3$620 at root, NACA 4415 at tip. Aspect ratio 16 : 1. Chord 42 in. (1.06 m.) at root, 23 in. (0.58 m.) at tip. Dihedral 2°. Incidence 5° at root. All-wood structure comprising main spar and light rear spar, plywood covering to rear spar, fabric-covered trailing-edge. Plain plywood-covered ailerons. Total aileron area 17.94 sq. ft. (1.66 m.^{2}). Gross wing area 144 sq. ft. (13.37 m.^{2}).

FUSELAGE. — Semi-monocoque elliptical-section structure with spruce frames and plywood skin.

TAIL UNIT.—Cantilever monoplane type. All-wood framework with plywood-covered fin and tailplane. Fabric-covered rudder and elevators. Areas: fin 7.38 sq. ft. (0.68 m.^{2}), rudder 7.5 sq. ft. (0.70 m.^{2}), tailplane 12.6 sq. ft. (1.17 m.^{2}), elevators 9.95 sq. ft. (0.92 m.^{2}). Span of tail 9 ft. 3¼ in. (2.82 m.).

LANDING GEAR.—Central skid and main landing wheel, and small tail-skid at base of rudder-post.

ACCOMMODATION.—Single enclosed cockpit. Back-type parachute.

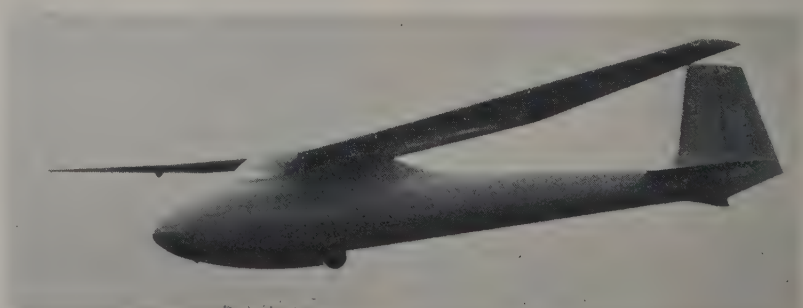
DIMENSIONS.—
Span 48 ft. (14.64 m.).
Length 24 ft. 6 in. (7.47 m.).
Height 5 ft. (1.52 m.).

WEIGHTS.—
Weight empty 444 lb. (201.5 kg.).
Weight loaded 680 lb. (309 kg.).

PERFORMANCE.—
Best glide ratio 30 : 1 at 43 m.p.h. (68.8 km.h.).
Min. sinking speed 2.3 ft./sec. (0.7 m./sec.).
Speed at sink of 6 ft./sec. (1.8 m./sec.) 73.3 m.p.h. (117.2 km.h.).
Min. speed at max. weight 36.7 m.p.h. (58.7 km.h.).

THE SLINGSBY TYPE 43 SKYLARK 3B.

The Type 43 is the latest version of the Skylark, with increased wing span and enlarged tail surfaces. Skylark 3's took five of the first six places, including the first, in League I of the British 1957 National Gliding Championships.



The Slingsby Type 41 Skylark 2 single-seat Sailplane.

Structural details are as for the Type 41 Skylark 2, with the following exceptions :—

WINGS.—Aspect ratio 20.5 : 1. Wing area 173 sq. ft. (16.0 m.²).

TAIL UNIT.—Areas : fin 10.5 sq. ft. (.97 m.²), rudder 9.6 sq. ft. (.89 m.²), tailplane 16 sq. ft. (1.49 m.²), elevator 11.8 sq. ft. (1.10 m.²). Tailplane span 9 ft. 5½ in. (2.88 m.).

LANDING GEAR.—Can have skid and droppable landing gear as alternative to skid and mono-wheel.

DIMENSIONS.—
Span 59 ft. 7 in. (18.16 m.).
Length 25 ft. (7.6 m.).
Height 5 ft. 9 in. (1.75 m.).

WEIGHTS.—
Weight empty 546 lb. (248 kg.).
Weight loaded 790 lb. (358 kg.).

PERFORMANCE.
Best glide ratio 36 : 1 at 46 m.p.h. (74 km.h.).
Min. sink speed 1.85 ft./sec. (.56 m./sec.) at 40 m.p.h. (65 km.h.).
Speed at sink of 6 ft./sec. (1.83 m./sec.) 78 m.p.h. (126 km.h.).
Min. speed at max. weight 36.2 m.p.h. (58.3 km.h.).

THE KIRBY TUTOR.

The Tutor is a secondary type sailplane which was evolved from the earlier Kirby Cadet by the fitting of a tapered wing of higher aspect ratio and the incorporation of a differential mechanism in the aileron control circuit.

DIMENSIONS.—
Span 43 ft. 3¾ in. (13.2 m.).
Other dimensions as for Cadet.

WEIGHTS.—
Weight empty 355 lb. (162 kg.).
Weight loaded 570 lb. (260 kg.).
Wing loading 2.98 lb./sq. ft. (14.6 kg./m.²).



The Slingsby Type 30 Prefect TX. Mk. 1 Intermediate Sailplane.

THE SLINGSBY TYPE 31 TANDEM TUTOR.

This is a development of the Tutor intermediate type sailplane. It has been specially designed to make a low-priced dual-control glider available for training purposes. Most of the components are interchangeable with those of the solo Tutor, saving jig and tool costs and simplifying stores. The flying characteristics of the Tutor and Tandem Tutor are almost identical, so that the *ab initio* pilot can graduate from one to the other with ease.

DIMENSIONS.—
Span 43 ft. 4¾ in. (13.2 m.).
Gross wing area 170 sq. ft. (15.8 m.²).
Standard mean chord 3.94 ft. (1.2 m.).
Aspect ratio 11 : 1.

WEIGHT EMPTY.—
608 lb. (280 kg.).

PERFORMANCE.—
Best gliding angle 1 in 21 at 42 m.p.h. (67.2 km.h.).
Min. sinking speed 2.8 ft./sec. (0.85 m./sec.) at 38 m.p.h. (60.8 km.h.).
Stalling speed 28 m.p.h. (41.6 km.h.).

THE SLINGSBY TYPE 30 PREFECT.

The Prefect is an intermediate type of sailplane in the semi-aerobatic category which was designed for use by civilian or service training organisations. It is suitable for cloud flying and cross-country flights, and includes among its equipment an airspeed indicator, sensitive altimeter, variometer, compass and electrical turn and bank indicator. Dive-brakes are a standard fitting. It is used by the R.A.F. as the Prefect TX. Mk. 1.

DIMENSIONS.—
Span 45 ft. (13.75 m.).
Length 20 ft. 8 in. (6.3 m.).
Height 4 ft. 2 in. (1.275 m.).
Max. wing chord 3 ft. 0½ in. (0.918 m.).
Tailplane span 9 ft. 2½ in. (2.8 m.).

WEIGHTS.—
Weight empty 390 lb. (177 kg.).

PERFORMANCE.—
Best gliding angle 1 in 21.
Min. sinking speed 2.6 ft./sec. (0.792 m. sec.).
Best flying speed 40 m.p.h. (64.6 km.h.).

WEIGHTS.—
Tare weight 389 lb. (176.5 kg.).
Disposable load 360 lb. (164 kg.).
All-up weight 750 lb. (341 kg.).

PERFORMANCE.—
Sinking speed at 36 m.p.h. (58 km.h.) 3.4 ft./sec. (1.02 m./sec.).
Gliding angle at 45 m.p.h. (73 km.h.) 18.5 to 1.
Stalling speed 32 m.p.h. (51.5 km.h.).

THE SLINGSBY TYPE 21B SEDBERGH.

The Type 21B is a two-seat side-by-side training glider which has been designed to meet the requirements for a simple type of dual instruction sailplane of medium performance and low price, suitable for gliding clubs and other training organizations.

The Type 21B is in service with the Air Training Corps. In its service form it is named the Sedbergh TX Mk. 1.

TYPE.—Two-seat Training Glider.

WINGS.—High-wing braced monoplane. Single-spar torsion-resisting nose-box structure with light secondary spar to carry ailerons. Wood construction with fabric covering aft of main spar. Single bracing struts on each side. Standard mean chord 4 ft. 9⅜ in. (1.47 m.). Aspect ratio 11.2. Gross wing area 260 sq. ft. (24.15 m.²).

FUSELAGE.—Of mixed construction. Forward portion back to two main wing attachment-frames of wood stressed skin construction, remainder of fabric-covered girder construction.

TAIL UNIT.—Braced tailplane. Rudder and elevators are fabric-covered. Span 12 ft. 6¾ in. (3.67 m.).

LANDING GEAR.—Single central skid followed by single wheel. Spring tail-skid.

ACCOMMODATION.—Open cockpit seating two side-by-side with dual controls. Provision for back-type parachutes. Two control columns and dual rudder pedals. Quick-release and lift-spoiler controls placed centrally.

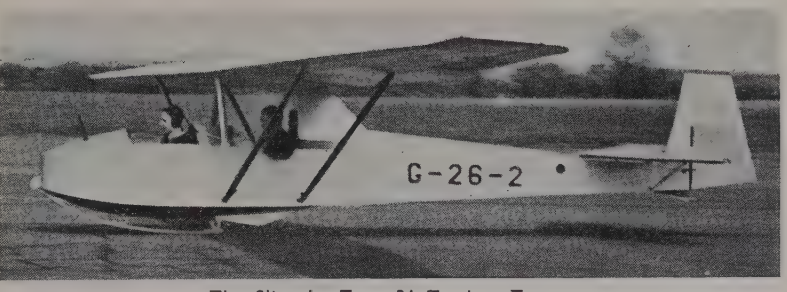
EQUIPMENT.—Instruments include A.S.I., Kollsman sensitive altimeter, Cobb-Slater variometer and Pullen electric turn-and-bank indicator. "Ottfur" type towing attachment mechanism.

DIMENSIONS.—
Span 54 ft. (16.47 m.).
Length 26 ft. 8 in. (8.13 m.).

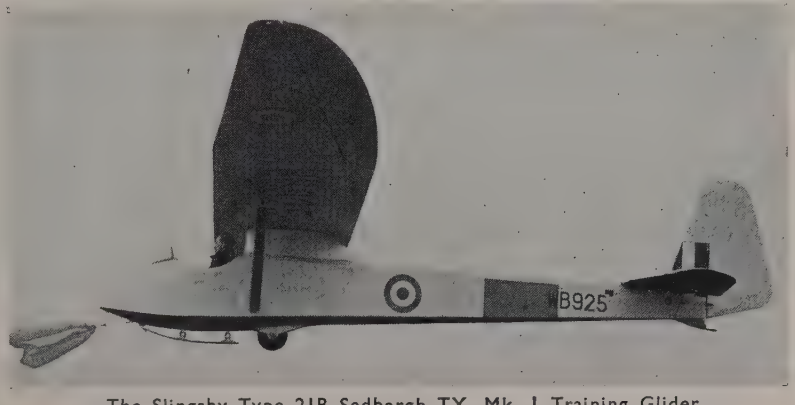
THE SLINGSBY TYPE 21 Mk. 2.

The Type 21 Mk. 2 differs from the Type 21B in having an enclosed cockpit and no wing-mounting pylon, the wings being attached directly to a fuselage centre-section. This increases the span to 57 ft. (17.37 m.). It will be available with dive brakes instead of spoilers.

The Type 21 Mk. 2 incorporates a high proportion of standard Type 21B components and fulfils the same rôle as an *ab initio* training glider. The improvements are expected to give it an improved performance.



The Slingsby Type 31 Tandem Tutor.



The Slingsby Type 21B Sedbergh TX. Mk. 1 Training Glider.

SOMERS KENDALL

SOMERS KENDALL AIRCRAFT, LTD.

HEAD OFFICE: EAGLE HOUSE, 109, JERMYN STREET, LONDON, S.W.1.

WORKS: WOODLEY AERODROME, NEAR READING, BERKS.

AERODROME: PANSHANGER, HERTFORD.

Directors: J. N. Somers, A.F.C. and W. Magalow.

Secretary: W. J. Miles, A.C.A.

The Somers Kendall Aircraft company was formed to design and build the SK.1 two-seat lightweight jet-powered training and sporting monoplane, the prototype of which flew for the first time on October 8, 1955. A full description of the SK.1 is given below.

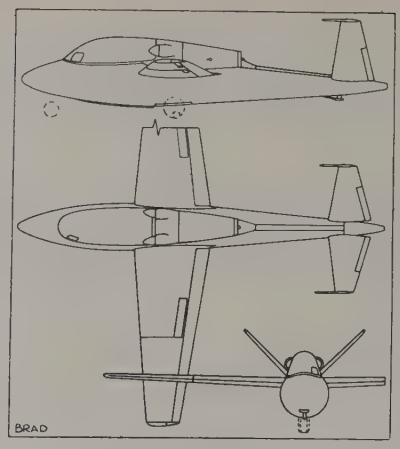
THE SOMERS KENDALL SK.1.

TYPE.—Two-seat Jet-Powered Training and Sporting aircraft.

WINGS.—Shoulder-wing cantilever monoplane. Wing section NACA 66 series. Aspect ratio 8. Chord 4 ft. 2 in. (1,27 m.) at root, 1 ft. 8 in. (0.51 m.) at tip. No dihedral. Incidence ½°. One-piece single-spar all-wood structure. Full-span all-wood ailerons which can be drooped together to work as flaps. Small manually-operated dive-brakes on upper and lower surfaces of wings forward of ailerons. Total area of ailerons 8.6 sq. ft. (0.80 m.²). Gross wing area 65 sq. ft. (6.04 m.²).

FUSELAGE.—All-wood semi-monocoque construction.

TAIL UNIT.—All-moving butterfly type, the two surfaces forming an inner angle of 45°. Wooden construction. Combined geared unbalancing and trim tabs. Total area of tail unit 14.9 sq. ft. (1.38 m.²).



The Somers Kendall SK.1.

LANDING GEAR.—Retractable tandem main wheels, with retractable wing-tip balancer wheels. Pneumatic retraction by air bled from engine compressor. Extension by gravity and springs, with manual assistance. Palmer wheels. Forward wheel steerable through 15° from rudder pedals. Manual brake on rear wheel. Solid rubber wheels on balancer units, which have vertical sprung travel of 5.7 in. (0.15 m.). Wheelbase 6 ft. 8 in. (2.04 m.).

POWER PLANT.—One Turbomeca Palas I turbojet engine, giving 350 lb. (159 kg.) s.t. for take-off and maximum continuous power of 265 lb. (120 kg.) s.t. Fuel and oil systems suitable for inverted flight. Fuel in two tanks in each wing, one forward and one aft of spar. Each forward tank capacity 13 Imp. gallons (59 litres). Each rear tank capacity 9 Imp. gallons (41 litres). Total fuel capacity 44 Imp. gallons (200 litres). Oil capacity 3 pints (1.70 litres). Electric ground and air starting.

ACCOMMODATION.—Enclosed cabin for two persons in tandem under one-piece Perspex canopy which hinges to starboard and is jettisonable. Dual controls. Radio and oxygen equipment.

DIMENSIONS.—
Span 22 ft. 10 in. (6.95 m.).
Length 20 ft. 11 in. (6.37 m.).
Height 5 ft. 6 in. (1.68 m.).

WEIGHTS.—
Weight empty 814 lb. (369 kg.).
Max. loaded weight 1,500 lb. (680 kg.).

PERFORMANCE (at 1,500 lb. = 680 kg. A.U.W.).—
Max. speed at S/L. 315 m.p.h. (507 km.h.).
Max. cruising speed at S/L. 265 m.p.h. (427 km.h.).
Max. cruising speed at 20,000 ft. (6,100 m.) 250 m.p.h. (402 km.h.).
Rate of climb at S/L. 1,850 ft./min. (565 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 900 ft./min. (275 m./min.).
Range at S/L. 250 miles (402 km.).
Range at 20,000 ft. (6,100 m.) 400 miles (645 km.).

SUPERMARINE

VICKERS - ARMSTRONGS (AIRCRAFT) LTD. (Supermarine Division).

WORKS: HURSLEY PARK, WINCHESTER, HANTS, AND SOUTH MARSTON, SWINDON, WILTS.

LONDON OFFICE: VICKERS HOUSE, BROADWAY, WESTMINSTER, S.W.1.

Directors: See under "Vickers."

General Manager (Supermarine Division): S. P. Woodley, M.B.E.

Chief Designer (Supermarine Division): A. N. Clifton, M.B.E., B.Sc., F.R.Ae.S.

The original Supermarine Company was formed in 1912 and its efforts were chiefly devoted to the production of sea-going aircraft.

In November, 1928, Vickers (Aviation) Ltd. took over the control of the Supermarine Aviation Works, Ltd. In October, 1938, the Supermarine Aviation Works (Vickers), Ltd., was, with its parent company Vickers (Aviation), Ltd., taken over by Vickers-Armstrongs, Ltd.

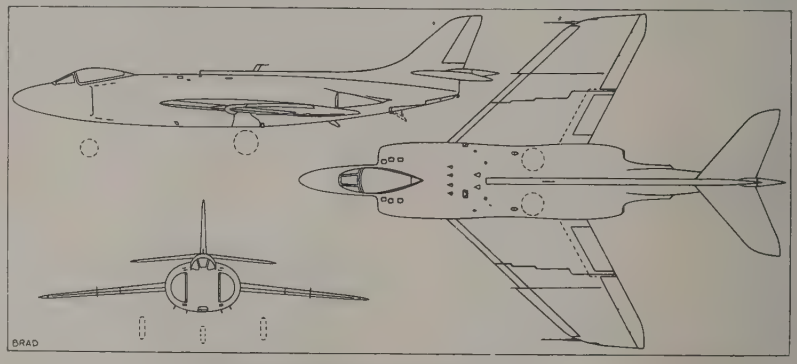
On January 1, 1955, a new Vickers-Armstrongs subsidiary, Vickers-Armstrongs (Aircraft), Ltd., took over the aircraft business previously carried on by the parent company.

Supermarine's first jet-propelled fighter, the Attacker, was supplied in numbers to the Royal Navy. A swept-wing version, the Type 510, was built for experimental purposes, and the Type 535 was a further development. This latter model was succeeded by the Swift, which is now in service in its Mk. 5 form in the Royal Air Force. A Mk. 7 version has been produced for operational testing of air-to-air missiles.

The latest Supermarine naval jet fighter is the Scimitar, a substantial order for which has been placed for the Royal Navy. It is a development of the Type 508, with the Type 525 serving as an interim development version. Details of these aircraft have appeared in earlier editions of "All the World's Aircraft," and the Scimitar itself is described hereafter.

THE SUPERMARINE SCIMITAR.

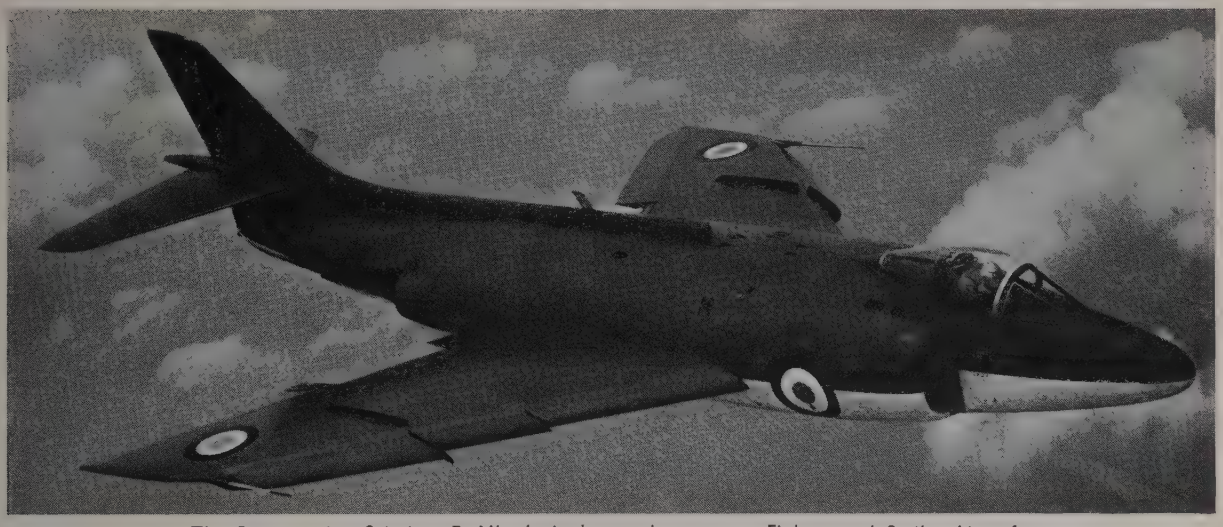
Known originally as the Supermarine N.113, the Scimitar F. Mk. 1 is a large



The Supermarine Scimitar F. Mk. 1.



The Supermarine Scimitar F. Mk. 1 (two Rolls-Royce Avon turbojet engines).



The Supermarine Scimitar F. Mk. 1 single-seat Interceptor Fighter and Strike Aircraft.

single-seat twin-engined Naval carrier-borne interceptor fighter and strike aircraft which is in production for the Royal Navy. It is a swept-wing monoplane and is powered by two Rolls-Royce Avon 200-Series turbojet engines which are mounted side-by-side amidships with the air intakes and jet exits on the sides of the fuselage fore and aft of the wings. The entire nose forward of the cockpit hinges to one side to give access to the nose-mounted radar scanner and to reduce the length of the aircraft for lift stowage. The wings have saw-tooth leading-edges and fences and an all-flying tail is fitted.

Production aircraft have a super-circulation, or "blown-flap," system wherein air ducted from the engine compressor is blown over the upper surfaces of the flaps to increase lift by local acceleration of the airflow. This provides a considerable reduction in the deck-landing approach speed for aircraft-carrier operation.

The prototype Scimitar flew for the first time on January 20, 1956, and initial deck-landing trials were successfully carried out in H.M.S. *Ark Royal* in the following April.

First production F. Mk. 1 aircraft are armed with four 30 mm. Aden cannon, but it has been announced that the Scimitar will be equipped with air-to-air missiles in due course, and it can also carry nuclear weapons.

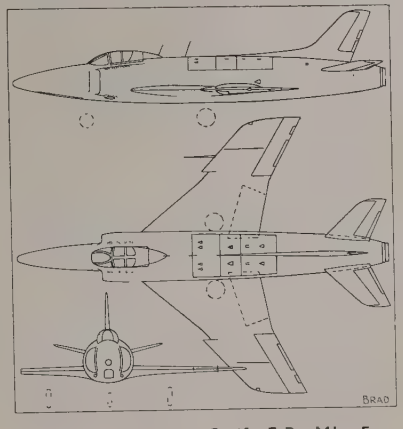
DIMENSIONS.—
Span 37 ft. 2 in. (11.33 m.).
Length 55 ft. 4 in. (16.87 m.).

THE SUPERMARINE SWIFT.

The Swift was originally designed as a single-seat high-altitude interceptor fighter and in its original F. Mk. 1 form flew for the first time on August 25, 1952. Although ordered into production for the Royal Air Force, the Swift did not meet the full operational requirements for an aircraft in the interceptor class. Four interceptor fighter versions were produced, of which only the Mks. 1 and 2 entered operational service with No. 56 Squadron of the Royal Air Force in 1954-55.

Thereafter, the operational rôle of the Swift was changed to that of fighter reconnaissance and the Swift F.R. Mk. 5 began to enter service with the R.A.F. in 1956. There is also a Mk. 7, details of which are given below.

Swift F.R. Mk. 5. Rolls-Royce Avon engine with afterburner. Fighter reconnaissance version. Longer nose to accommodate camera equipment. Three F.95 cameras are usually installed. Armament consists of two 30 mm. Aden cannon. Provision for four rockets under each outer wing panel and for 220 Imp. gallon jettisonable fuel tank under fuselage.



The Supermarine Swift F.R. Mk. 5.

Swift F. Mk. 7. For service trials of air-to-air guided weapons, and general assessment and training in guided weapon operational techniques. Guns replaced by extra fuel tanks. Nose and wind-screen redesigned. Wing span increased by about 3 ft. (0.91 m.).

Details of the Swift Mk. 5 follow :—

TYPE. — Single-seat Fighter-Reconnaissance monoplane.

WINGS.—Low-wing cantilever monoplane. 40° sweepback at 25% chord line. Saw-tooth leading-edges. All-metal structure. Gross wing area 306 sq. ft. (28.43 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All surfaces swept back. Variable incidence tailplane. Tailplane span 12 ft. 11 in. (3.93 m.).

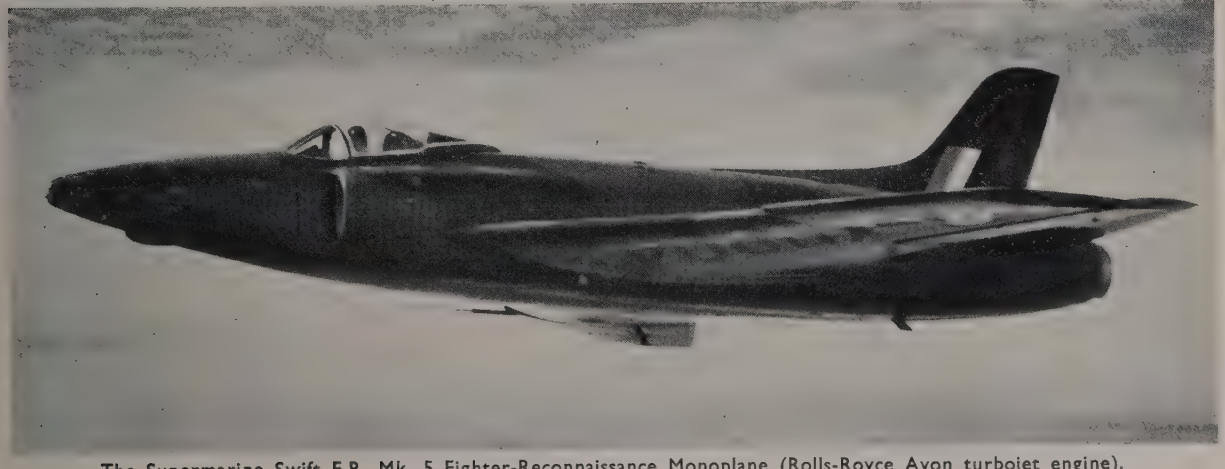
LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Wheel track 15 ft. 2½ in. (4.64 m.). Wheelbase 14 ft. 10 in. (4.52 m.).

POWER PLANT.—One Rolls-Royce Avon axial-flow turbojet engine with afterburner.

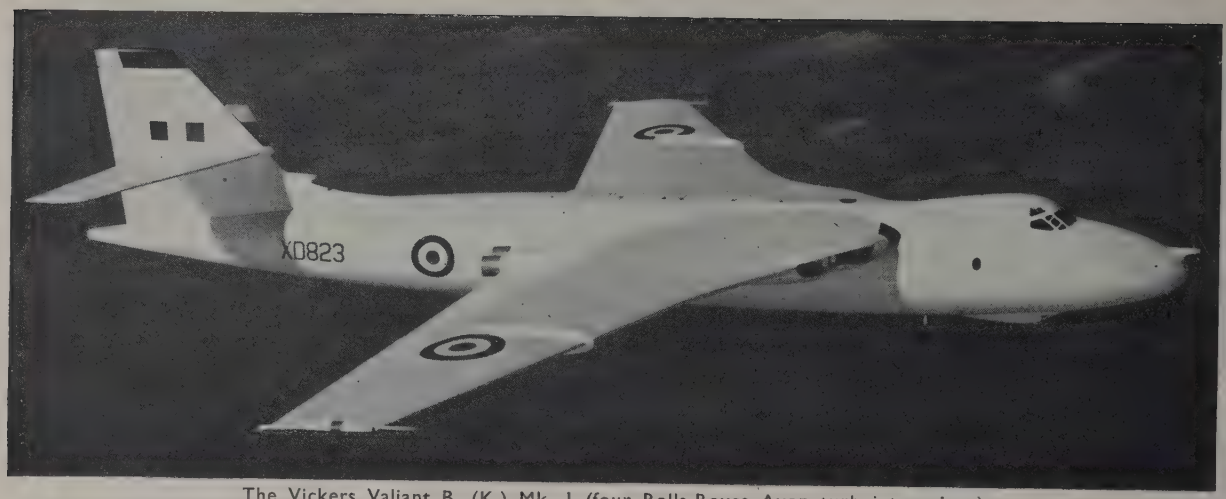
ACCOMMODATION.—Single-seat cockpit. Jettisonable canopy. Ejection seat.

ARMAMENT.—Two 30 mm. Aden cannon. Provision for four air-to-ground rockets under each outer wing panel.

DIMENSIONS.—
Span 32 ft. 4 in. (9.86 m.).
Length 41 ft. 5¼ in. (12.63 m.).
Height 13 ft. 6 in. (4.11 m.).



The Supermarine Swift F.R. Mk. 5 Fighter-Reconnaissance Monoplane (Rolls-Royce Avon turbojet engine).



The Vickers Valiant B. (K.) Mk. 1 (four Rolls-Royce Avon turbojet engines).

VICKERS - ARMSTRONGS (AIRCRAFT) LIMITED.

AVIATION WORKS: WEYBRIDGE, SURREY.

LONDON OFFICE: VICKERS HOUSE, BROADWAY, WESTMINSTER, S.W.1.

Affiliated Companies:

Vickers-Armstrongs (Australia) Pty. Ltd., Melbourne, South Australia.

Vickers-Armstrongs (South Africa) Pty. Ltd., Johannesburg.

Vickers (Eastern), Ltd., Bombay, India

Vickers-Armstrongs, Inc., Washington, D.C., U.S.A.

Directors: Major-General C. A. L. Dunphie, C.B., C.B.E., D.S.O. (Chairman); Sir George R. Edwards, C.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E. (Managing Director); J. Anderson; T. Gammon, O.B.E., M.I.Mech.E.; E. J. Waddington, A.C.A.; R. P. H. Yapp; H. H. Gardner, B.Sc., F.R.Ae.S. (Chief Engineer, Military Aircraft); A. W. E. Houghton; B. Stephenson, F.R.Ae.S. (Chief Engineer, Civil Aircraft); and S. P. Woodley.

Chief of Aeronautical Research and Development: B. N. Wallis, C.B.E., F.R.S., R.D.I., B.Sc. (Hon.), M.Inst. C.E., F.R.Ae.S.

Chief Engineer (Guided Weapons): Brigadier J. Clemow, M.A.

Vickers (Aviation), Ltd. was formed in July, 1928, when Vickers, Ltd. formed their Aviation Department into a separate subsidiary company to take over the manufacture of aircraft, aircraft accessories and equipment. In November, 1928, Vickers (Aviation), Ltd. took over the control of the Supermarine Aviation Works, Ltd.

In October, 1938, Vickers (Aviation), Ltd. and the Supermarine Aviation Works (Vickers), Ltd. were taken over by Vickers-Armstrongs, Ltd.

In December, 1954, as part of a reorganisation of Vickers-Armstrongs, Ltd., a new subsidiary company known as Vickers-Armstrongs (Aircraft) Ltd. was formed to acquire the aircraft business which was at that time carried on at Weybridge, Supermarine and other works. The take-over took place on July 1, 1955, although the acquisition was back-dated to January 1, 1955. The Board of Directors of the new company is as above.

Vickers aircraft were operated in the 1914-18 War and subsequently have covered a wide range of types in both military and civil spheres.

The last Valiant four-jet bomber was delivered on August 27, 1957, and production is centred at present on the Viscount, which was the first civil airliner powered with turboprop engines to fly and the first to enter regular service.

On May 10, 1957, Vickers were able to announce that the 200th Viscount had been delivered (to Philippine Air Lines) and that 370 Viscounts had been sold to 33 airlines, 6 governments and 5 private operators in 30 different countries.

In addition, Vickers are developing two completely new airliners, the turboprop Vanguard and turbojet VC10, of which details will be found hereafter.

THE VICKERS TYPE 674 VALIANT.

The Valiant is a four-jet high-performance swept-wing bomber, powered by four Rolls-Royce Avon turbojet engines, which can be supplemented for take-off by two de Havilland Super Sprite liquid-propellent rocket motors in jettisonable under-wing pods. The first prototype flew for the first time on May 18, 1951, and the second prototype made its maiden flight on April 11, 1952.

The mention of five versions of the Valiant is permitted. These are:—

Valiant B. Mk. 1. Four Rolls-Royce Avon RA.14 engines. First production model. Outward-retracting twin-wheel main landing-gear units. Fitted for flight refuelling. Crew of five.

Valiant B. (P.R.) Mk. 1. B. Mk. 1 equipped for photographic reconnaissance.

Valiant B. (P.R.) K. Mk. 1. Similar to B. Mk. 1 but equipped for triple rôle as bomber, photographic reconnaissance aircraft and flight refuelling tanker/receiver. Refuelling probe on fuselage nose.

Valiant B. (K.) Mk. 1. Four Rolls-Royce Avon RA.28 engines. Final production version.

Valiant B. Mk. 2. Developed from Mk. 1. Backward-retracting eight-wheel bogie landing-gear units housed, when retracted, in fairings extending beyond wing trailing-edge. Longer fuselage nose. Flew for the first time on September 4, 1953. Not proceeded with.

The Valiant B. Mk. 1 went into R.A.F. squadron service in 1955 and has been used for operational tests of Britain's atomic and thermo-nuclear bombs.

No further details of the Valiant were available for publication at the time of writing.

DIMENSIONS.—

Span 114 ft. 4 in. (34.85 m.).
Length 108 ft. 3 in. (33.00 m.).

THE VICKERS VC10.

B.O.A.C. announced in May, 1957 its intention to buy 35 Vickers VC10 long/medium-range airliners, valued at about £68 million, including spares. Delivery will begin in 1963.

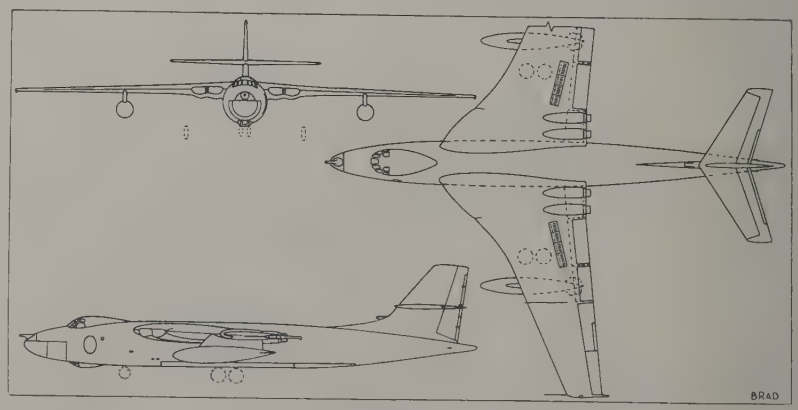
Few details of the VC10 are available except that it will have a "double-bubble" fuselage of similar appearance to that of the Vanguard and will be powered by four Rolls-Royce Conway by-pass turbojet engines. The upper deck will accommodate up to 147 tourist passengers, with very capacious freight holds on the lower deck.

Regarding performance, the manufacturers have stated that the VC10 "will have a cruising speed competitive with that of other jet aircraft operating in the mid-1960's; but, in addition, it will have an especially good airfield performance at high-level and high-temperature airfields."

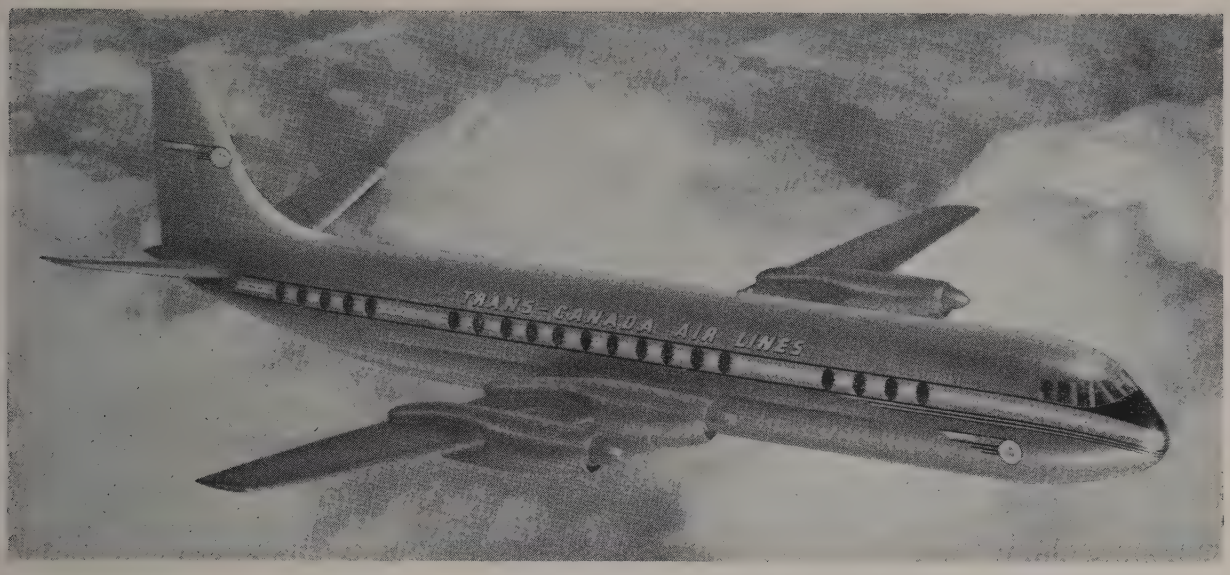
No further details of the VC10 were available at the time of going to press.

THE VICKERS VANGUARD 950 SERIES.

The Vanguard, plans for which were made public in October, 1955, is a completely new addition to the Vickers "family" of turboprop airliners. It is designed to offer fast and highly economic operation on all airline routes of up to



The Vickers Valiant B. (K.) Mk. 1.



An impression of the Vickers Vanguard Airliner (four Rolls-Royce Tyne turboprop engines).

2,600 miles (4,160 km.), the design being based on Vickers' experience of meeting the requirements of over thirty operators with the extremely successful Viscount.

An important feature of the Vanguard is its "double-bubble" fuselage, providing accommodation for 76-117 passengers on the upper deck and unusually generous freight stowage in the two lower-deck cargo compartments. For off-peak or off-season operation these compartments can be filled with 17,000 lb. (7,710 kg.) of freight, enabling the Vanguard to carry a full payload with only 30 per cent. of its seats filled. Alternatively, the lower deck can be used for low-density freight.

British European Airways and Trans-Canada Air Lines have each ordered a fleet of 20 Vanguards, in the following versions :—

Type 951. Twenty for B.E.A. with Stage 1 Rolls-Royce Tyne turboprops rated at 4,020 s.h.p. plus 1,175 lb. (535 kg.) residual thrust.

Type 952. Twenty for Trans-Canada Air Lines. Generally similar to Type 951, but with higher design weights and design cruising speed to give greater flexibility of operation. This version will operate at normal cruise power (13,500 r.p.m.) at altitudes down to 8,000 ft. (2,500 m.) in I.S.A. conditions and down to less than 5,000 ft. (1,500 m.) in I.S.A.+ 15°C. conditions at its maximum "zero-fuel" weight.

An all-freight version with stiffened floor, large loading door and maximum payload of 40,000 lb. (18,145 kg.) is also projected.

There will not be a Vanguard prototype as such ; the first aircraft will be built from production jigs and is scheduled to fly in the autumn of 1958. First deliveries of Vanguards are due in the Spring of 1960.

The following details apply specifically to the Vanguard Type 951 as ordered by B.E.A. :

TYPE.—Four-engined Airliner.

WINGS.—Mid-wing cantilever monoplane. NACA 63 Series (modified) wing section. Aspect ratio 9.1. Chord 17 ft. 1 in. (5.21 m.) at root, 6 ft. 5.8 in. (1.98 m.) at tip. Dihedral 6°. Incidence 2½°. Light-alloy torsion-box structure. Aerodynamically-balanced light-alloy ailerons. Hydraulically-operated Fowler-type light-alloy flaps inboard of ailerons. Thermal leading-edge anti-icing. Total area of ailerons 124 sq. ft. (11.5 m.²). Total area of flaps (flaps-up, projected) 314 sq. ft. (29.1 m.²). Gross wing area 1,527 sq. ft. (142.0 m.²).

FUSELAGE.—"Double-bubble" section. Pressurised. Conventional light-alloy construction using open frames and stringers.

TAIL UNIT.—Cantilever monoplane type. All-metal stressed-skin structure. Electrical anti-icing. Areas : fin 220 sq. ft. (20.4 m.²), rudder 88 sq. ft. (8.2 m.²), tailplane 322 sq. ft. (29.9 m.²), elevators 146 sq. ft. (13.5 m.²). Tailplane span 47 ft. 8 in. (14.53 m.).

LANDING GEAR.—Retractable tricycle type with Vickers-type twin nose-wheel and twin-wheel main units. Hydraulic actuation. Dunlop or Goodyear wheels and hydraulic brakes with provision for anti-skid units. Wheelbase 40 ft. 6.35 in. (12.35 m.). Track (oleo centres) 30 ft. (9.15 m.)

POWER PLANT.—Four Rolls-Royce R.B.109 Tyne turboprop engines rated at (initially) 4,020 s.h.p. plus 1,175 lb. (535 kg.) residual thrust. de Havilland four-blade constant-speed and reversing airscrews 14 ft. 6 in. (4.42 m.) in diameter. Fuel in four integral tanks, two per wing. Inner tanks hold 1,850 Imp. gallons (8,400 litres) each, outer tanks 700 Imp. gallons (3,180 litres) each. Total fuel capacity 5,100 Imp. gallons (23,150 litres). Pressure under-wing fueling/defueling system, plus over-wing filler caps.

ACCOMMODATION (Type 951). — Standard accommodation for 76 (first class), 96 (standard) or 117 (tourist) passengers, three flight crew and four cabin attendants, but cabin arranged to provide maximum flexibility of seating arrangements combined with easy conversion to alternative layouts. Interior dimensions of cabin 90 ft. 2 in. long, 9 ft. 11 in. maximum width and 6 ft. 10 in. maximum height (27.48 × 3.02 × 2.08 m.). Standard main cabin is divided into three separate saloons with vestibule containing pantry in front and a toilet and wardrobe at aft end. Forward and central saloons separated by three toilets and wardrobe, and central and rear saloons by rear vestibule. Seats (for first-class version) are four abreast throughout, or (for tourist version) five abreast except last two rows where seats are four abreast. Hydraulically-operated built-in folding passenger stairs to forward and rear vestibules on port side. In lower segment of fuselage below cabin floor are two baggage and freight compartments, forward compartment of 750 cub. ft. (21.23 m³.) and rear compartment of 610 cub. ft. (17.27 m.³) capacity. Freight compartment headroom 4 ft. 3 in. (1.29 m.), freight doors 5 ft. 6 in. (1.67 m.) wide. Freight door sills 4 ft. 8 in. (1.42 m.) above ground. Passenger cabin, flight deck and all freight and baggage compartments pressurised to maintain sea level conditions to 15,000 ft. (4,575 m.) and 8,000 ft. (2,440 m.) conditions to 30,000 ft. (9,150 m.). Cloud and collision-warning scanner in unpressurised nose section.

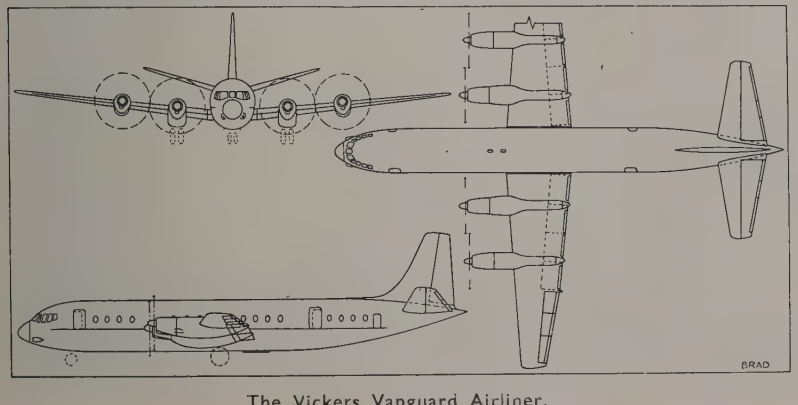
ACCOMMODATION (Type 952). — Standard accommodation for 82 first class or 102 tourist passengers ; but cabin arranged to make possible a mixed class version of 60% tourist and 40% first class seating. Four washrooms and two galleys.

DIMENSIONS.—
Span 118 ft. (35.96 m.).
Length 122 ft. 10⅛ in. (37.38 m.).
Height 35 ft. (10.67 m.).

WEIGHTS (Type 951, designed).—
Weight empty 73,115 lb. (33,164 kg.).
Max. T.O. weight 135,000 lb. (61,235 kg.).
Max. landing weight 108,500 lb. (49,215 kg.).
Max. "zero fuel" weight 98,500 lb. (44,680 kg.).
Designed max. payload (nominal) 21,000 lb. (9,525 kg.).
Current max. payload as limited by "zero fuel" weight 22,200 lb. (10,070 kg.).

WEIGHTS (Type 952, designed).—
Max. T.O. weight 141,000 lb. (63,956 kg.).
Max. landing weight 114,000 lb. (51,710 kg.).
Max. "zero fuel" weight 104,500 lb. (47,400 kg.).
Designed max. payload 25,000 lb. (11,340 kg.).

PERFORMANCE (Type 951, estimated).—
Cruising speed at 108,500 lb. (49,260 kg.) A.U.W. 400 m.p.h. (640 km.h.).
Still-air range with 21,000 lb. (9,535 kg.)



The Vickers Vanguard Airliner.



The Vickers Viscount Type 742 as supplied to the Brazilian Air Force.

payload, without reserves 3,150 miles (5,040 km.).
Still-air range with reserve fuel for one hour holding at 5,000 ft. (1,525 m.) and diversion of 230 miles (370 km.), plus 5% overall route reserve 2,600 miles (4,160 km.).

PERFORMANCE (Type 952, estimated).—
Cruising speed approx. 424 m.p.h. (680 km.h.).

THE VICKERS VISCOUNT 700 SERIES.

The Viscount 700 Series comprises four basic versions, the 700, 700D, 770D and 771D.

The original Type 700 prototype flew for the first time on August 28, 1950, as a 40/48-passenger aircraft and powered by four 1,400 s.h.p. Rolls-Royce Dart 504 engines.

In November, 1953 the Dart 506 engine was announced. This engine gives an additional 80-90 horsepower under cruising conditions which results in an average increase in cruising speed of 18 m.p.h. (29 km.h.) at a reduced specific fuel consumption. All Type 700 aircraft fitted with the Dart 506 are now cleared for an all-up weight of 60,000 lb. (27,240 kg.). They can also be modified to take the later 1,600 s.h.p. Dart 510 engine if required.

The Viscount 700D has the same airframe as the 700 but is fitted with four 1,600 s.h.p. Dart 510 engines, has increased fuel capacity (1,950 Imp. gallons = 8,850 litres) and an increased take-off weight (63,000 lb. = 28,576 kg.) and landing weight (57,000 lb. = 25,855 kg.).

The long-range version of the 700D has a 145 Imp. gallon (660 litre) slipper tank fitted under each wing outboard of the outer engine nacelles. Slipper tanks are filled through the main refueling nozzle. The fifth aircraft delivered to Trans-Australia Airlines was the first Viscount to be fitted with slipper tanks.

The 770D is the basic North American version of the 700D. It has all the standardised refinements and improved performance of the 700D but, in addition, it embodies North American equipment and the modifications needed to meet special CAA requirements, one of which is that the maximum landing weight be raised to 57,500 lb. (26,082 kg.).

The 771D is the basic "plush" version of the 770D and incorporates all the optional installations so far chosen by the principal North American customers. These include built-in folding passenger stairs with front door passenger loading, racks for carry-on luggage, propeller brakes, Janitrol heater and a standard 48-seat cabin layout with two toilets.

Hereafter follows a complete listing of the Viscount 700/700D variants as they existed at the time of closing for press.

Type 700. Prototype (G-AMAV) of 700 Series. Originally four 1,400 s.h.p. Rolls-Royce Dart 504 engines. First flew on August 28, 1950. Has been used for development flying in connection with both Viscount and Vanguard development programmes. Powered by four Dart 510 engines G-AMAV has achieved level speeds of approximately 400 m.p.h. (640 km.h.) at 25,000 ft. (7,625 m.), using water/methanol power-restoration and high r.p.m., to test high-speed control characteristics for future models with this performance. Fitted in 1957 with one Dart RDa.7 (Mk. 520) engine and Viscount 810-type horn-balanced rudder.

Type 701. Four Rolls-Royce Dart 505 (early aircraft) or 506 (later aircraft) turboprop engines. All now fitted with Mk. 506 engines. Twenty-seven for British European Airways. First production 701 flew on August 20, 1952. B.E.A. inaugurated the World's first turboprop-powered passenger services with Viscount on April 18, 1953. Now seating 47 passengers, but will be progressively modified into 56-seaters for high-density routes as B.E.A.'s Series 800 Viscounts enter service.

Type 702. Four Rolls-Royce Dart 506 engines. Four for British West Indian Airways. 44-53 passenger configuration. A.U.W. 60,000 lb. (27,216 kg.).

Type 707. Four Rolls-Royce Dart 505 engines. Mk. 506 engines fitted later. Four for Aer Lingus (Irish Air Lines). 53 passengers.

Type 708. Four Rolls-Royce Dart 505 engines. Mk. 506 engines fitted later. Twelve for Air France. 49 passengers.

Type 720. Four Rolls-Royce Dart



The Vickers Viscount Type 745 Airliner (four Rolls-Royce Dart turboprop engines) in Capital Airlines' colours.

505 or 506 engines. Seven for Trans-Australia Airlines, first four with Dart 505 engines and last three with Dart 506 engines and slipper-type long range tanks. 44-seat interior.

Type 723. One for Indian Air Force. Dart 506 engines. 35-passenger transport with luxury interior (see also Type 730).

Type 724. Four Rolls-Royce Dart 506 engines. Fifteen for Trans-Canada Air Lines. 40/48-seat interior. Have special provisions for cold weather flying, including additional heating for passenger, crew and baggage compartments, increased electrical power, etc. Remaining thirty-six of T.C.A. fleet are Type 757 (which see).

Type 730. One for Indian Air Force. Dart 506 engines. V.I.P. interior for Presidential use.

Type 732. Three for Hunting-Clan Air Transport, Ltd. Dart 506 engines. 53-59 passenger layout. Leased to Middle East Airlines. Two further aircraft (700D), ordered in November, 1954, are Type 759 (which see).

Type 734. One V.I.P. aircraft for Pakistan Government for Presidential use. Dart 506 engines.

Type 735. Three for Iraqi Airways. Dart 510 engines. 44-53 passenger layout. (See also Type 773).

Type 736. Two for Fred Olsen's Flyselskap A/S (Norway). Dart 506 engines. 48-52 passenger layout. On lease to B.W.I.A. and Middle East Air Lines respectively.

Type 737. One for Canadian Department of Transport. For official use. Airframe same as Type 724 but with 22-seat V.I.P. interior.

Type 739. Three for Misrair S.A.E. (Egypt). Dart 506 engines. 40-seat interior.

Type 742. One (700D) originally for Braathen's S.A.F.E. (Norway), but now taken over by the Brazilian Government. 52-seat interior. (See also Type 789).

Type 744. First three for Capital Airlines, ordered in June, 1954, are of this type. 44/48-seat interior. Are modifications of Type 701 made available from B.E.A. production.

Type 745. Fifty-seven for Capital Airlines. Of these aircraft, first nine delivered with Dart 506 engines for subsequent conversion to 510 engines, remainder delivered with Dart 510 engines. 44/48-seat interior.

Type 747. Two for Butler Air Transport, Ltd. (Australia). Option for further four. Dart 506 engines. 40-seat interior.

Type 748. Five (700D) for Central African Airways Corporation. D.H. propellers. 47-seat interior. First two have provision for slipper tanks, last three delivered with slipper tanks.

Type 749. Three for Linea Aeropostal Venezolana. Dart 506 engines. 40-seat interior basically similar to Type 744.

Type 754. Eight (700D) for use by B.O.A.C. Associates (Eastern routes). 44/48-seat interior.

Type 755. Three ordered by Airwork, Ltd. and sold to Compañia Cubana de Aviacion prior to delivery. Dart 510 engines. 46-seat interior.

Type 756. Seven (700D) for Trans-Australia Airlines. Balance of order for fourteen, first seven being of Type 720 (which see).

Type 757. Thirty-six for Trans-Canada Air Lines. Dart 506 engines. Balance of order for a total of fifty-one; first fifteen being of Type 724 (which see).

Type 759. Two (700D) for Hunting-Clan Air Transport, Ltd. Balance of order for five, first three being of Type 732 (which see). Sold to Icelandair in 1957. 53-seat interior.

Type 760. Two (700D) for Hong Kong Airways. To be fitted with slipper tanks. 40/44-seat interior.

Type 761. Three (700D) for Union of Burma Airways. 48-seat interior.

Type 763. One (700D) for Howard Hughes Tool Company of Delaware, U.S.A. Similar internal layout to Type 745, but furnishings supplied in United States. Will be used for study and analysis of turboprop-powered aircraft.

Type 764. Three (700D) for United States Steel Corporation. Special long-range aircraft with two wing slipper tanks (145 Imp. gallons=660 litres) and one fuselage "belly" tank (450 Imp. gallons=2,045 litres). Executive interiors installed in the United States.

Type 765. One (700D) for Standard Oil Company of California. Executive interior installed in United States. Fitted with 450 Imp. gallons (2,045 litres) belly tank.

Type 768. Ten (700D) for Indian Airlines Corporation. 44-seat interior.

Type 769. Three (700D) for PLUNA (Uruguay). 48-seat interior.

Type 772. Four for B.O.A.C. Associates (Western routes). Dart 506 engines. 48-seat interior.

Type 773. One (700D) for Iraqi Airways. 44-seat interior. Balance of order for four, first three being of Type 735 (which see).

Type 779. Four (700D) for Fred Olsen Airtransport. Balance of order for six, first two being of Type 736 (which see). 48-seat interior.

Type 781. One (700D) for South African Air Force. V.I.P. furnishing.

Type 782. Three (700D) for Government of Iran, two for Persian Air Services (48 seats) and one for personal use of The Shah.

Type 784. Two (770D) for Philippine Air Lines. Standard version as developed for North American operators.

Type 785. Ten (770D) for Linee Aeree Italiane. 48-seat interior.

Type 786. Three (770D) for Lloyd Aereo Colombiano. 48-seat interior.

Type 789. One for Brazilian Government (see also Type 742). V.I.P. furnishing.

Type 794. Five for Turkish Airlines (THY).

The description below refers to the Viscount 700 Series in general.

TYPE—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 63 modified. Aspect ratio 9.17. All-metal structure with stressed Alclad skin. Double-slotted flaps between Irving-type ailerons and fuselage. Thermal de-icing. Root chord 14 ft. 10 in. (4.54 m.). Tip chord 4 ft. 5 in. (1.35 m.). Dihedral 4° 30′. Aileron area 47.4 sq. ft. (4.4 m.²). Total flap area 156 sq. ft. (14.43 m.²). Gross wing area 963 sq. ft. (89.3 m.²).

FUSELAGE.—All-metal stressed-skin structure. The entire fuselage except nose-wheel retraction bay and extreme rear is pressurized to 6½ lb./sq. in. (0.45 kg./cm.²).

TAIL UNIT.—Cantilever monoplane structure. Single fin and rudder and 15° dihedral on tailplane. All-metal construction. Spring tabs in all control surfaces. Thermal de-icing. Total tailplane area 203 sq. ft. (18.8 m.²). Elevator area (including tabs) 104 sq. ft. (9.67 m.²). Fin area 62 sq. ft. (5.75 m.²). Rudder area 62 sq. ft. (5.75 m.²).

LANDING GEAR.—Retractable tricycle type, hydraulically-operated. All units have single Vickers shock-absorbers supporting twin wheels. Dunlop or Goodyear wheels and brakes. Wheel track 23 ft. 10 in. (7.27 m.); wheel base 24 ft. 10.6 in. (7.58 m.).

POWER PLANT.—Four 1,400 s.h.p. Rolls-Royce Dart 506 (700 Series) or 1,600 s.h.p. Dart 510 (700D Series) turboprop engines, each driving a four-blade Rotol or D.H. fully-feathering 10 ft. (3.05 m.) diameter airscrew. Total internal fuel capacity 1,720 Imp. gallons (7,810 litres) in bag-type tanks forward and aft of main wing spar. Water methanol system for boosted take-off; total capacity 75 Imp. gallons (340 litres).

ACCOMMODATION.—Normal accommodation for 40 passengers, but up to 59 can be seated in high-density version. Normal crew of three or four, comprising two pilots and one or two cabin attendants. Separate crew station for radio-operator/navigator optional; when not carried, radio and radar are operated by remote control from second pilot's seat. Pantry forward of main cabin, toilet compartment at the rear. Three large freight and luggage compartments, one forward of main cabin, capacity 110 cub. ft. (3.11 m.³) one aft with separate door on starboard side, capacity 204 cub. ft. (5.77 m.³) one below floor level forward, with two access doors, capacity 215 cub. ft. (6.08 m.³). Continuous main passenger cabin with seats each side of central gangway. Cabin height



The Vickers Viscount Type 724 Airliner (four Rolls-Royce Dart turboprop engines) in service with Trans-Canada Air Lines.

6 ft. 5 in. (1.96 m.). Maximum width at arm-rest level is 9 ft. 5 in. (2.88 m.). Combined pressurization, air-conditioning and temperature control, giving ground-level conditions up to 15,000 ft. (4,575 m.) and 8,000 ft. (2,440 m.) conditions at 30,000 ft. (9,150 m.). Provision for external air conditioning when on ground.

DIMENSIONS.—
Span 93 ft. 8½ in. (28.5 m.).
Length 81 ft. 9 in. (24.93 m.).
Height 27 ft. 9 in. (8.46 m.).

WEIGHTS (700 Series—3-crew 40-passenger layout).—
Weight empty (equipped—includes crew, oil, etc.) 36,859 lb. (16,718 kg.).
Max. payload and catering allowance 12,141 lb. (5,507 kg.).
Max. "zero fuel" weight 49,000 lb. (22,226 kg.).
Max. all-up weight 60,000 lb. (27,216 kg.).
Max. landing weight 54,000 lb. (24,494 kg.).

WEIGHTS (700D—2-crew, 40-passenger layout).—
Weight empty (equipped—includes crew, oil, etc.) 37,868 lb. (17,177 kg.).
Max. payload and catering allowance 11,632 lb. (5,276 kg.).
Max. "zero fuel" weight 49,500 lb. (22,453 kg.).
Max. all-up weight 63,000 lb. (28,576 kg.).
Max. landing weight 57,500 lb. (26,082 kg.).

WEIGHTS (770D Series—North American basic version).—
As for 700D Series except :—
Weight empty 38,061 lb. (17,264 kg.).

PERFORMANCE (700 Series—3-crew 40-passenger layout).—
Cruising speed on max. continuous power at 53,000 lb. (24,000 kg.) at 25,000 ft. (7,625 m.) under I.C.A.N. conditions 323 m.p.h. (517 km.h.).
Cruising speed on recommended power at 53,000 lb. (24,000 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 324 m.p.h. (518 km.h.).
Rate of climb on max. continuous power at 58,500 lb. (26,560 kg.), I.C.A.N. conditions flaps up, on four engines, 1,200 ft./min. (366 m./min.) at sea level and 700 ft./min. (202 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb on take-off power at 58,500 lb. (26,560 kg.), I.C.A.N. conditions, 20° flap and landing gear up, take-off power and one engine inoperative 732 ft./min. (223 m./min.) at sea level, and 540 ft./min. (165 m./min.) at 6,000 ft. (1,830 m.).
Ceiling (based on rate of climb of 200 ft./min. = 61 m./min.) I.C.A.N. conditions at 52,000 lb. (23,608 kg.) on max. continuous power 28,500 ft. (8,680 m.).
Take-off distance to 50 ft. (15.2 m.) at 58,500 lb. (26,560 kg.), I.C.A.N. sea level conditions, four engines, 1,430 yds. (1,307 m.).
Take-off distance to 50 ft. (15.2 m.) at 58,500 lb. (26,560 kg.), I.C.A.N. sea level conditions, with one engine failure at critical point, 1,680 yds. (1,536 m.).
Landing distance from 50 ft. (15.2 m.) at 52,000 lb. (23,608 kg.), I.C.A.N. conditions, 950 yds. (870 m.).
Range and payload depend on operational requirement and fuel reserves.

PERFORMANCE (700D—2-crew, 40-passenger layout).—
Cruising speed on max. continuous power at 54,000 lb. (24,500 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 334 m.p.h. (534 km.h.).
Cruising speed on recommended power at 54,000 lb. (24,500 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 324 m.p.h. (518 km.h.).
Rate of climb on max. continuous power at 60,000 lb. (27,215 kg.) I.C.A.N. conditions, flaps up, on four engines 1,400 ft./min. (426 m./min.) at sea level and 700 ft./min. (213 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb on take-off power at 60,000 lb. (27,215 kg.) I.C.A.N. conditions, 20° flap, landing gear up and one engine inoperative 750 ft./min. (229 m./min.) at sea level and 520 ft./min. (159 m./min.) at 6,000 ft. (1,829 m.).
Ceiling based on a rate of climb of 200 ft./min. = 61 m./min.) I.C.A.N. conditions at 54,000 lb. (24,500 kg) on max. continuous power 27,500 ft. (8,320 m.).
Take-off distance to 50 ft. (15.2 m.) at 60,000 lb. (27,215 kg.) I.C.A.N. sea level conditions, four engines, 1,320 yds. (1,210 m.).
Take-off distance to 50 ft. (15.2 m.) at 60,000 lb. (27,300 kg.) I.C.A.N. sea level conditions with one engine inoperative at critical point 1,550 yds. (1,416 m.).
Landing distance from 50 ft. (15.2 m.) at 54,000 lb. (24,500 kg.) I.C.A.N. sea level conditions 1,023 yds. (936 m.).
Range and payload depend on operational requirements and fuel reserves.

THE VICKERS VISCOUNT 800 SERIES.

The Viscount 800 Series airliner is a "stretched" version of the 700, which is particularly suitable for high-density short-haul routes. It is not intended as a replacement of the 700 Series but as a complementary aircraft.

The first Series 800 Viscount, a Type 802 for B.E.A., made its first flight on July 27, 1956.

The fuselage of the 800 Series is 46 inches (1.17 m.) longer than that of the 700, while the rear pressure bulkhead has been moved aft by 65 inches (1.65 m.), giving a total extra cabin length of 111 inches (2.82 m.). This enables the aircraft to carry from 44 to 70 passengers as compared with the 40-54 seats of the 700 Series.

The seating arrangements in the 800 Series can be very flexible. Seventy passengers can be accommodated in twelve rows of five seats, two rows of four and one row of two. In a four-abreast arrangement there can be fourteen rows plus two extra seats (58 total) or, in an extra spacious layout, eleven rows of four (44 total).

One of the features of the 800 Series is that the pantry and forward bulkhead is mounted on rails so that the capacity of the cabin compartment can be adjusted between freight and passengers. When necessary the seats can be folded out of the way to make room for freight. The floor of the forward part of the cabin has been strengthened to take concentrated freight loads. To facilitate the loading of freight, the forward entrance door is rectangular and specially large.

Except for the fuselage all other features, including wings and power-plant, are the same as for the 700D.

Type 802. Four 1,600 s.h.p. Rolls-Royce Dart RDa.6 (Mk. 510) engines. Twenty-four ordered by B.E.A. Fifty-seven-seat configuration with maximum sector distance with full load of 950 miles (1,520 km.). For shorter high-peak routes accommodation can be for either 65 or 70 passengers. Maximum payload in passengers and freight in this B.E.A. configuration is 12,744 lb. (5,479 kg.) for a range of 650 miles (1,040 km.) with full reserves. The first 802 entered service in February, 1957.

Type 803. Four Rolls-Royce Dart RDa.6 (Mk. 510) engines. Nine for K.L.M. Royal Dutch Airlines. Payload of 12,000 lb. (5,450 kg.) and a range with maximum payload of 600 miles (960 km.). 53/63-seat interior. Deliveries began in mid-1957.

Type 804. Four Rolls-Royce RDa.6 (Mk. 510) engines. 67-seat interior. Two for Transair, Ltd., British independent operator.

Type 805. Two for Eagle Aviation Ltd.

Type 806. As Type 802 but powered by four Dart RDa.7 (Mk. 520) engines to give increased cruising speed of 365 m.p.h. (587 km.h.). Not convertible to RDa.11 engines. Sixteen ordered by B.E.A. One fitted temporarily with Dart RDa.7/1 (Mk. 525) engines during 1957



The Vickers Viscount Type 802 Airliner (four 1,600 s.h.p. Rolls-Royce Dart Mk. 510 turbojet engines).



The first Vickers Viscount Type 806 temporarily fitted for development purposes with four Dart Mk. 525 engines such as will power the 810 Series Viscount, hence the hybrid name Viscount 806-810.

for tropical trials as part of Viscount 810 Series development programme. Known as the Type 806/810, this aircraft (G-AOYF) flew for the first time on August 9, 1957. It is approved for operation at an A.U.W. of 69,000 lb. (31,300 kg.).

Type 807. Four Rolls-Royce Dart RDa.6 (Mk. 510) engines. Three ordered by New Zealand National Airways Corporation. 52/60-seat interior.

Type 808. Four Rolls-Royce Dart RDa.6 (Mk. 510) engines. Three ordered by Aer Lingus (Irish Air Lines). 65-seat interior.

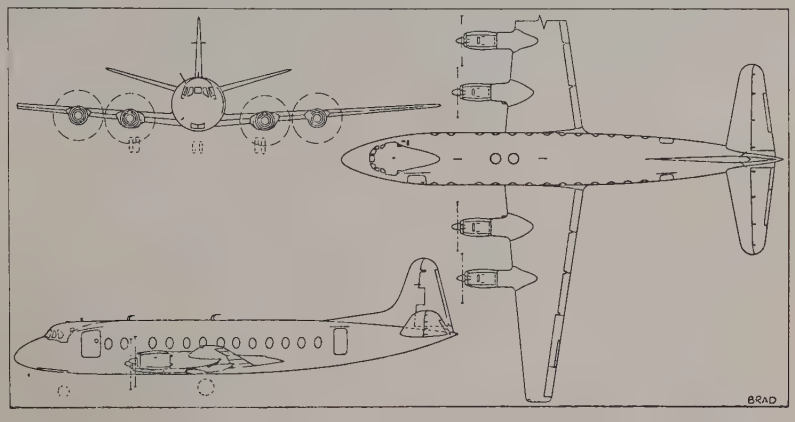
DIMENSIONS.—
Same as 700 Series except:
Length 85 ft. (25.91 m.).

WEIGHTS (3-crew 52-seat layout).—
Weight empty (equipped—includes crew, oil, etc.) 40,776 lb. (18,496 kg.).
Max. payload and catering allowance 13,224 lb. (5,999 kg.).
Max. "zero-fuel" weight 54,000 lb. (24,494 kg.).
Max. take-off weight 63,000 lb. (28,576 kg.).
Max. landing weight 58,500 lb. (26,535 kg.).

PERFORMANCE.—
Cruising speed on max. continuous power at 55,000 lb. (24,950 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 325 m.p.h. (519 km.h.).
Cruising speed on recommended power at 55,000 lb. (24,950 kg.) at 20,000 ft. (6,100 m.) under I.C.A.N. conditions 314 m.p.h. (503 km.h.).
Rate of climb on max. continuous power at 62,000 lb. (28,120 kg.) I.C.A.N. conditions, flaps up, four engines, 1,220 ft./min. (372 m./min.) at sea level and 540 ft./min. (165 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb on take-off power at 62,000 lb. (28,120 kg.). I.C.A.N. conditions, 20° flap, landing gear up and one engine inoperative 680 ft./min. (207 m./min.) at sea level and 460 ft./min. (140 m./min.) at 6,000 ft. (1,829 m.).
Ceiling (based on a rate of climb of 200 ft./min. = 61 m./min.) I.C.A.N. conditions at 55,000 lb. (24,950 kg.) on max. continuous power 27,000 ft. (8,230 m.).
Take-off distance to 50 ft. (15.2 m.) at 62,000 lb. (28,120 kg.) I.C.A.N. sea level conditions, four engines, 1,470 yds. (1,345 m.).
Landing distance from 50 ft. (15.2 m.) at 57,000 lb. (25,855 kg.) I.C.A.N. sea level conditions 1,120 yds. (1,024 m.).
Range and Payload depend on operational requirements and fuel allowances, but max. still air range with slipper tanks and max. payload will be 1,035 miles (1,756 km.).
Take-off distance to 50 ft. (15.2 m.) at 62,000 lb. (28,120 kg.) I.C.A.N. sea level with one engine inoperative at critical point 1,720 yds. (1,578 m.).

THE VICKERS VISCOUNT 810/840 SERIES.

These improved versions of the Viscount are the outcome of continuous development work on both the airframe and the Rolls-Royce Dart engine.



The Vickers Viscount 800 Series Airliner.

The Viscount 810 will be of similar external appearance to the Viscount 800 Series but will be powered by Dart RDa.7/1 (Mk. 525) engines delivering 1,990 e.h.p. (1,800 s.h.p.) at take-off. These engines which are de-rated for take-off and therefore offer a reserve of power at high-altitude and high-temperature aerodromes, will be available in 1958. By installing Dart RDa.11 (Mk. 541) engines (restricted to 1,800 s.h.p. to ensure maintenance of full power up to 17,000 ft. = 5,200 m.), available in 1959, the Viscount 810 can be converted into the Viscount 840. Typical cruising speeds of these new versions will be 365 m.p.h. = 584 km.h. (Type 810) and 400 m.p.h. = 640 km.h. (Type 840).

By comparison with previous versions, the Viscount 810-840 Series will incorporate structural modifications permitting them to operate at increased speeds and weights. Unlike the 800 Series they are not intended primarily for short-haul routes, being capable of operating with full payload over all stages from 200 to 1,200 miles (320 to 1,920 km.).

In standard form the Viscount 810-840 Series will have first-class accommodation for 52 passengers. The fuselage has provision for built-in passenger steps and nose-mounted radar. Dimensions are as for the 700 Series, except that the fuselage length has been increased to 85 ft. 7 in. (26.10 m.).

Type 810. One development aircraft (G-AOYV) for operation by Vickers. To be fitted temporarily with Dart 520 engines up-rated to give Dart 525 powers.

Type 812. Fifteen for Continental Air Lines. 52-seat interior with rear lounge. Will be delivered with 2,100 s.h.p. Dart RDa.7/1 engines but will be re-engined in 1959 with 2,500 e.s.h.p. RDa.11 engines and will thus become Type 840.

Type 813. Seven for South African Airways. 56-seat interior.

Type 814. Nine for Deutsche Lufthansa. 54/60-seat interior.

Type 815. Three for Pakistan International Airlines. 51-seat interior. Slipper tanks.

Type 818. Four for Compañia Cubana de Aviacion. 52-seat interior. Slipper tanks.

Type 819. One for Niarchos Group. Equipped as executive aircraft.

Type 825. One for Black Lion Aviation.

Type 827. Five for V.A.S.P. (Brazil).

DIMENSIONS.—
Same as 800 Series.

WEIGHTS (810 Series).—
Weight empty (equipped—includes crew, oil, etc.) 40,776 lb. (18,496 kg.).
Max. payload and catering allowance 12,881 lb. (5,842 kg.).
Max. T.O. weight 67,500 lb. (30,645 kg.).
Max. "zero fuel" weight 54,500 lb. (24,745 kg.).
Max. landing weight 60,000 lb. (27,240 kg.).

WEIGHTS (840 Series).—
Weight empty (equipped—includes crew, oil, etc.) 42,209 lb. (19,146 kg.).
Max. payload and catering allowance 12,791 lb. (5,801 kg.).
Max. T.O. weight 69,000 lb. (31,325 kg.).
Max "zero fuel" weight 55,000 lb. (24,970 kg.).
Max. landing weight 60,000 lb. (27,240 kg.).

WESTLAND

WESTLAND AIRCRAFT, LTD.

HEAD OFFICE, WORKS AND AERODROME: YEOVIL, SOMERSET.

LONDON OFFICE: 8, THE SANCTUARY, WESTMINSTER, S.W.1.

Directors: Eric Mensforth, C.B.E., M.A., M.I.Mech.E., F.R.Ae.S., M.I.P.E. (Chairman); Lord Aberconway (Deputy Chairman); Edward C. Wheeldon, M.I.P.E. (Managing Director); D. L. Hollis Williams, B.Sc., F.R.Ae.S. (Technical Director); D. C. Collins, M.I.Mech.E., M.I.P.E. (Works Director); Walter Oppenheimer, F.C.A. (Finance); Sir George E. Bailey, C.B.E.; Sir Norman J. Hulbert, D.L., J.P. and General Sir Kenneth Crawford, K.C.B., M.C.

Chief Engineer: O. L. L. Fitzwilliams, B.A. (Eng.), A.F.R.Ae.S.

Chief Designer: P. E. Q. Shunker, B.Sc., A.F.R.Ae.S., M.I.Ae.S.

Secretary: C. T. Jones, A.S.A.A.

Westland Aircraft, Ltd. was formed in July, 1935, to take over the aircraft branch of Petters, Ltd., previously known as the Westland Aircraft Works, which had been engaged in aircraft design and construction since 1915.

Since the war Westland has developed the Wyvern Naval strike aircraft and a series of helicopters, of which the first was the Sikorsky S-51, built under licence as the Westland Dragonfly.

Production of the Wyvern was completed in 1956, since when the whole of Westland's resources have been concentrated on the design, development and construction of helicopters. The company is now the largest manufacturer of helicopters in Europe, with a production total in excess of 300 by mid-1957.

Currently, Westland have in production three separate types of helicopters, the Widgeon, Whirlwind and Wessex; with a fourth, the Westminster, in an advanced stage of development.

A subsidiary company, Normalair, Ltd., specialises in the design and manufacture of aircraft cabin atmosphere control systems, associated oxygen equipment and high-altitude breathing apparatus. Able to supply complete aircraft installations, Normalair, Ltd. are recognised as the foremost European authority in this field. All British pressurised aircraft, both civil and military, use Normalair equipment, as do many aircraft of foreign design.

THE WESTLAND DRAGONFLY.

Westland acquired the licence to build the Sikorsky S-51 helicopter in 1947 and this aircraft became the first helicopter of British manufacture to receive a Certificate of Airworthiness. Since then the Westland-built S-51, or Dragonfly, has been supplied to many commercial operators in England and abroad.

Westland also developed a special military version with modified cabin, large radio bay and other additions to meet the requirements of the R.A.F. and Royal Navy, and foreign naval and air forces. The military Dragonfly has been produced in the following versions, all of which are in service.

Dragonfly H.R. Mk. 1. Alvis Leonides 50 engine. Fully-equipped for Sea Rescue and special photography. Supplied to the Royal Navy. One experimental H.R. Mk. 1 flying with four-blade rotor.

Dragonfly H.C. Mk. 2. Alvis Leonides 50 engine. Primarily equipped for casualty evacuation. Two stretcher cases may be carried in enclosed panniers, one on each side of fuselage, with alternative cabin accommodation for sitting casualties. Supplied to the Royal Air Force.

Dragonfly H.R. Mk. 3. Alvis Leonides 50 engine. All-metal main rotor blades and hydraulic servo control mechanism. In service with Royal Navy.

Dragonfly H.C. Mk. 4. Alvis Leonides 50 engine. Improved H.C. Mk. 2 with all-metal main rotor blades and hydraulic servo control mechanism. In service with the Royal Air Force.

Two civil versions of the Dragonfly are in service:—

Mk. IA. Alvis 521/1 engine. Equipped passenger transport or several other rôles.

Mk. IB. Pratt & Whitney R-985 engine. Otherwise same as Mk. IA.

A structural description of the Dragonfly has appeared in earlier editions of this annual.

DIMENSIONS.—
Main rotor diameter (Dragonfly Mk. 1 and 2) 48 ft. (14.64 m.).
Main rotor diameter (Dragonfly Mk. 3 and 4) 49 ft. (14.94 m.).
Overall length 57 ft. 6¼ in. (17.54 m.).
Length of fuselage 41 ft. 1⅜ in. (12.53 m.).
Overall width 41 ft. 9 in. (12.73 m.).
Height to top of rotor pylon 12 ft. 11⅜ in. (3.93 m.).
Diameter of anti-torque rotor 8 ft. 5 in. (2.56 m.).

WEIGHTS (Civil Mk. IA).—
Weight empty 4,366 lb. (1,980 kg.).
Useful load 530 lb. (240 kg.).
Disposable load 1,334 lb. (606 kg.).
Normal loaded weight 5,700 lb. (2,587 kg.).
Max. loaded weight 5,870 lb. (2,660 kg.).

WEIGHTS (Dragonfly Mk. 1).—
Weight empty 4,380 lb. (1,988 kg.).
Disposable load 1,490 lb. (676 kg.).
Normal loaded weight 5,870 lb. (2,665 kg.).

WEIGHTS (Dragonfly Mk. 2).—
Weight empty (including panniers) 4,450 lb. (2,020 kg.).
Disposable load 1,420 lb. (645 kg.).
Weight loaded 5,870 lb. (2,665 kg.).

WEIGHTS (Dragonfly Mk. 4).—
Weight empty (including panniers) 4,520 lb. (2,052 kg.).
Disposable load 1,350 lb. (613 kg.).
Weight loaded 5,870 lb. (2,665 kg.).

PERFORMANCE (Civil Mk. IA).—
Max. speed at S/L. 103 m.p.h. (164.8 km.h.)
Cruising speed 85 m.p.h. (136 km.h.).
Hovering ceiling (without ground effect) 6,000 ft. (1,830 m.).
Hovering ceiling (with ground effect) 8,000 ft. (2,440 m.).
Service ceiling 11,000 ft. (3,360 m.).
Still air range 300 miles (480 km.) with fuel reserve for 20 min. further flight.

PERFORMANCE (Dragonfly Mk. 1).—
Max. speed at S/L. 95 m.p.h. (152 km.h.).
Cruising speed 85 m.p.h. (136 km.h.).
Hovering ceiling (without ground effect) 4,600 ft. (1,403 m.).
Hovering ceiling (with ground effect) 5,600 ft. (1,708 m.).
Best rate of climb at S/L. 800 ft./min. (244 m./min.).
Vertical rate of climb at S/L. 50 ft./min. (15.25 m./min.).
Service ceiling 12,400 ft. (3,780 m.).
Still air range 300 miles (480 km.).

PERFORMANCE (Dragonfly Mk. 2 with panniers).—
Max. speed at S/L. 88 m.p.h. (141 km.h.).
Cruising speed 78 m.p.h. (125 km.h.).
Still air range 275 miles (440 km.).
Other figures as for Mk. 1.

PERFORMANCE (Dragonfly Mk. 3).—
Max. speed at S/L. 95 m.p.h. (152 km.h.).
Cruising speed 85 m.p.h. (136 km.h.).
Hovering ceiling (without ground effect) 6,000 ft. (1,830 m.).
Hovering ceiling (with ground effect) 7,000 ft. (2,135 m.).
Best rate of climb at S/L. 1,000 ft./min. (305 m./min.).
Vertical rate of climb at S/L. 260 ft./min. (79 m./min.).
Service ceiling 13,200 ft. (4,030 m.).
Still air range 300 miles (480 km.).

PERFORMANCE (Dragonfly Mk. 4 with panniers).—
Max. speed at S/L. 88 m.p.h. (141 km.h.).
Cruising speed 78 m.p.h. (125 km.h.).
Still air range 275 miles (440 km.).
Other figures as for Mk. 3.

THE WESTLAND WIDGEON.

The Widgeon is a developed version of the Dragonfly which has an entirely new forward fuselage to seat five. The power-plant is the same as for the Dragonfly but a Whirlwind-type rotor-head incorporating offset flapping hinges gives improved mechanical qualities and a greater C.G. range and eliminates ballasting for differing loading arrangements.

The cabin has a length of 6 ft. 3 in. (1.90 m.), height of 4 ft. 3 in. (1.30 m.), maximum width of 4 ft. 10 in. (1.47 m.) and floor width of 3 ft. 10 in. (1.16 m.). A clamshell door is provided on the port side of the nose for stretcher loading.

The Widgeon is available in four main versions: as a passenger carrier with accommodation for pilot and four passengers; as an ambulance to carry pilot, two stretcher cases entirely within the cabin and medical attendant; as a rescue aircraft with a hydraulically-operated winch; or as a freight transport able to carry an external load of up to 1,000 lb. (455 kg.). The versatility of each version can be extended by fitting Westland pontoon landing gear instead of wheels, for operation from land and water.

Conversion from passenger to ambulance rôle has been achieved in as little as four minutes.

The Widgeon prototype made its first flight on August 23, 1955. Production Widgeons have been ordered by the Brazilian Navy, the Hong Kong Government and Bristow Helicopters Ltd.

In addition, Westland have received a contract to convert a large number of the Royal Navy's Dragonfly helicopters to Widgeon standard.

TYPE.—Five-seat Single-rotor Helicopter.

ROTORS.—Three-blade main rotor and three-blade anti-torque tail rotor. Main rotor-blades of all-metal construction with area of 27.8 sq. ft. (2.58 m.²) each. Disc area of main rotor 1,900 sq. ft. (176.5 m.²). Blades attached to hub through offset flapping



The Westland Dragonfly H.R. Mk. 1 Naval Helicopter (550 h.p. Alvis Leonides 50 engine).



The Westland Widgeon five-seat Helicopter (500 h.p. Alvis Leonides engine).

hinges. Hub is splined to drive-shaft, with top and bottom horizontal plates bolted to it. Three flapping and drag hinge units, spindles and sleeves to carry main blades, and three hydraulic dampers. Tail rotor of laminated wood construction with steel-sheathed leading edges. Disc area of tail rotor 55.65 sq. ft. (5.16 m.²). Vertical drive to main rotor runs from engine to centrifugally-operated clutch and fan unit, and through Hardy Spicer coupling to gear-box. Shaft drive from main gear-box through intermediate gear-box to tail rotor gear-box. Main rotor/engine r.p.m. ratio 1 : 11.88. Anti-torque rotor/engine r.p.m. ratio 1 : 1.80.

FUSELAGE.—Semi-monocoque light alloy cabin and tail cone, tubular steel centre section.

LANDING GEAR.—Three-wheel type with swivelling nose-wheel. Turner pneumatic shock-absorbers in main units. Westland oleo-pneumatic shock-absorber in nose-wheel unit. Dunlop Type AH8943 main wheels with 725 × 10 tyres. Dunlop Type AH8944 nose-wheel with 600 × 6.5 tyre. Tyre pressures 37 lb./sq. in. (2.60 kg./cm.²). Track 12 ft. (3.66 m.). Wheelbase 10 ft. (3.05 m.).

POWER PLANT.—One Alvis Leonides 521/1 nine-cylinder air-cooled radial engine, giving maximum power of 500 h.p. for five minutes at 3,000 r.p.m., maximum continuous power of 375 h.p. at 2,800 r.p.m. and maximum weak mixture power of 305 h.p. at 2,800 r.p.m. Mounted horizontally on tubular steel structure above centre-section bottom truss. Front and rear firewalls isolate engine bay from fuel tanks. Baffle plate above bay accommodates cooling fan. Fuel tanks forward and aft of engine bay, each with capacity of 41.6 Imp. gallons. Total fuel capacity 83.2 Imp. gallons (378 litres). Oil capacity 6.5 Imp. gallons (29.5 litres).

ACCOMMODATION. — Enclosed cabin with normal accommodation for pilot and passenger side-by-side in front and rear bench seat for three persons. Alternatively can be equipped to carry two stretchers and medical attendant as well as pilot. Sliding door on each side of cabin. Clamshell door on port side of nose for stretcher loading.

DIMENSIONS.—
Main rotor diameter 49 ft. 2 in. (14.99 m.).
Length of fuselage 40 ft. 10 in. (12.44 m.).
Overall width of fuselage 5 ft. 10 in. (1.77 m.).
Height to top of rotor pylon 13 ft. 2¾ in. (4.04 m.).
Anti-torque rotor diameter 8 ft. 5 in. (2.57 m.).

WEIGHTS.—
Weight empty 4,424 lb. (2,007 kg.).
Weight loaded 5,900 lb. (2,676 kg.).

PERFORMANCE.—
Max. speed at S/L. 104 m.p.h. (167 km.h.).
Cruising speed 81 m.p.h. (130 km.h.).
Rate of climb at S/L. 700 ft./min. (125 m./min.).
Service ceiling 10,500 ft. (3.190 m.).
Hovering ceiling 5,000 ft. (1,525 m.).
Max. range 310 miles (500 km.).

THE WESTLAND WHIRLWIND.

The Whirlwind exists in six military versions. These are :—

Whirlwind H.A.R. Mk. 1. 600 h.p. Pratt & Whitney R-1340-40 engine. For Royal Navy.

Whirlwind H.A.R. Mk. 2. 600 h.p. Pratt & Whitney R-1340-40 engine. For Royal Air Force.

Whirlwind H.A.R. Mk. 3. 700 h.p. Wright R-1300-3 engine. For Royal Navy.

Whirlwind H.A.R. Mk. 4. 600 h.p. Pratt & Whitney R-1340-57 engine. For Royal Air Force.

Whirlwind H.A.R. Mk. 5. 750 h.p. (de-rated) Alvis Leonides Major Mk. 155 engine. For Royal Navy.

Whirlwind Mk. 6. Projected version with Blackburn Twin-Turmo shaft-turbine. Cancelled.

Whirlwind H.A.S. Mk. 7. First helicopter built in Britain specifically for anti-submarine duties. Carries equipment and weapons to detect, locate and destroy submarines, including homing torpedo in special open bay under cabin. To accommodate this, cabin floor has been raised and under-floor fuel tanks repositioned on each side of bay. First deliveries to Royal Navy in mid-1957.

A number of Sikorsky-built S-55 helicopters have been supplied to the Royal Navy under M.D.A.P. and these have now been given designations in the "Whirlwind" series as follows :—

Whirlwind H.A.R. Mk. 21. Sikorsky-built HRS-2 transport helicopter in service in the Royal Navy. 550 h.p. Pratt & Whitney R-1340 engine.

Whirlwind H.A.S. Mk. 22. Sikorsky-built H04S-3 anti-submarine and rescue helicopter in service with the Royal Navy. 700 h.p. Wright R-1300 engine.

The naval versions of the Whirlwind can be fitted with a hook, attached to the rear of the cabin, for towing mine-sweeping gear.

The Westland Whirlwind in its Series 1 civil form, powered by the Pratt & Whitney R-1340 engine, has been supplied to British European Airways for passenger transport and to other European commercial organisations. The Series 2 civil version has an Alvis Leonides Major Mk. 755 engine.

The following specification applies



Westland Whirlwind H.A.R. Mk. 4 Helicopters for delivery to the Royal Air Force.



The Westland Whirlwind H.A.S. Mk. 7 Naval Anti-Submarine Helicopter (750 h.p. Alvis Leonides Major engine).

generally to both the military and civil versions of the Whirlwind :—

TYPE.—Military or Civil Helicopter.

ROTOR.—Three-blade main rotor, two-blade anti-torque tail rotor. Main rotor blades on offset flapping hinges with hydraulic damping about drag hinges. Swash-plate control mechanism. All-metal blades have extruded spars and light alloy skinned trailing-edges. Main rotor blade area 32.5 sq. ft. (3.02 m.²) each. Disc area of main rotor 2,206 sq. ft. (204.93 m.²). Disc area of tail rotor 61 sq. ft. (5.66 m.²). Main rotor drive by inclined shaft through helical bevel gears and double epicyclic reduction. Main rotor/engine r.p.m. ratio 11.3 : 1 (13.62 : 1 in versions with Leonides Major). Anti-torque rotor/engine r.p.m. ratio 1.62 : 1 (1.95 : 1 in versions with Leonides Major).

FUSELAGE.—Rectangular light alloy semi-monocoque structure with metal cone extension carrying tail rotor. All aircraft of later production series have drooped tail-cone, to give greater clearance between main and tail rotor blades, a spring-loaded tail-skid, repositioned stabilisers and a redesigned tail rotor pylon.

LANDING GEAR.—Four-wheel type, with forward pair of wheels castoring and rear pair taking main landing and brake loads. Turner air-oil shock struts. Dunlop wheels and brakes. Track 11 ft. (3.35 m.) main wheels, 4 ft. 6 in. (1.37 m.) nose wheels. Wheelbase 10 ft. 4 in. (3.15 m.).

POWER PLANT.—One 600 h.p. Pratt & Whitney R-1340-40 Wasp, 700 h.p. Wright R-1300-3 or 750 h.p. (de-rated) Alvis Leonides Major Mk. 155 or Mk. 755 radial air-cooled engine on inclined axis in nose compartment and driving main rotor gearbox by sloping shaft. Nose doors give access to engine installation. Fuel tanks under cabin floor with capacity of 145 Imp. gallons (657 litres) on versions with R-1340 and R-1300 engines, 170 Imp. gallons (773 litres) on versions with Leonides Major. Oil capacity 10 Imp. gallons (45 litres).

ACCOMMODATION.—Cockpit seating two side-by-side with dual controls in nose above engine. Main cabin 6 ft. × 10 ft. × 5 ft. 6 in. (1.82 m. × 3.05 m. × 1.67 m.) directly under rotor head can accommodate wide variety of loads, including 10 fully-armed troops, six stretchers, etc. Loading door 4 ft. × 4 ft. (1.22 m. × 1.22 m.) on starboard side. Power operated pilot-controlled hydraulic hoist for lifting loads while hovering. Cargo capacity 340 cub. ft. (9.6 m.³).

DIMENSIONS.—
Main rotor diameter 53 ft. (16.1 m.).
Overall length 62 ft. 1½ in. (18.95 m.).
Length of fuselage 41 ft. 8½ in. (12.71 m.).
Overall width 45 ft. 9½ in. (13.94 m.).
Height to top of rotor pylon 13 ft. 3 in. (4.04 m.).
Diameter of anti-torque rotor 8 ft. 11 in. (2.74 m.).

WEIGHTS (Civil Whirlwind).—
Weight empty 5,010 lb. (2,280 kg.).
Disposable load 2,490 lb. (1,130 kg.).
Weight loaded 7,500 lb. (3,420 kg.).

WEIGHTS (Mk. 1).—
Weight empty 5,286 lb. (2,400 kg.).
Disposable load 2,214 lb. (1,105 kg.).
Normal loaded weight 7,500 lb. (3,405 kg.).

WEIGHTS (Mk. 5).—
Weight empty 5,580 lb. (2,531 kg.).
Max. loaded weight 7,800 lb. (3,538 kg.).

PERFORMANCE (Mk. 1).—
Max. speed at S/L. 109 m.p.h. (176 km.h.).
Cruising speed 86 m.p.h. (138 km.h.).
Best rate of climb at S/L. 800 ft./min. (244 m./min.).
Service ceiling 7,000 ft. (2,130 m.).
Still air range 300 miles (480 km.).

PERFORMANCE (Mk. 5).—
Max. speed at S/L. 109 m.p.h. (176 km.h.).
Cruising speed for max. range 86 m.p.h. (139 km.h.).
Rate of climb at S/L. 1,080 ft./min. (330 m./min.).
Hovering ceiling 5,500 ft. (1,680 m.).
Range 335 miles (539 km.).

THE WESTLAND WESSEX.

The name Wessex has been given to a new helicopter which resembles the Sikorsky S-58 in general layout but is powered by a Napier Gazelle shaft-turbine. This engine is mounted in the fuselage nose, behind clamshell doors, driving main and tail rotors each with four all-metal blades. The tail is hinged to fold for ease of stowage.

The Wessex has been ordered for service with the Royal Navy and will be used primarily for anti-submarine duties, carrying special search equipment and strike weapons. It will, however, be equally suitable for search and rescue, freight-carrying, casualty evacuation, training or communications. In addition to a flight crew of two, with dual servo-operated controls, there will be accommodation for 12 passengers and baggage or eight stretchers. In the supply rôle, the Wessex will have internal capacity for 2,000 lb. (907 kg.) of freight and an external sling load capacity of 4,000 lb. (1,814 kg.).

The prototype for the Wessex, using a Sikorsky S-58 airframe, but re-engined with a Napier Gazelle shaft-turbine, made its first flight on May 17, 1957. First deliveries of the Wessex are scheduled for 1958, and it may be available for civil operations in due course.

Structural details are generally similar to those of the Sikorsky S-58, with the following exceptions :—

ROTOR DRIVE.—Shaft drive to main rotor through double epicyclic reduction gear. Shaft drive to tail rotor through intermediate and tail gearboxes. Gas generator r.p.m. depends upon load conditions, but main rotor r.p.m. constant at 223, with tail rotor turning at 1,320 r.p.m.

POWER PLANT.—One Napier Gazelle NGa.13 shaft-turbine engine developing 1,430 s.h.p. (max. 1 hour) at S/L. and a max. continuous power of 1,200 s.h.p. Fuel tank under cabin floor. Oil capacity 5 Imp. gallons (22.7 litres).

DIMENSIONS.—
Overall length 65 ft. 9½ in. (20.05 m.).
Overall length, tail folded 38 ft. 2 in. (11.63 m.).
Height to top of tail rotor 15 ft. 10 in. (4.82 m.).

WEIGHTS.—
Weight equipped 7,600 lb. (3,447 kg.).
Weight loaded 12,600 lb. (5,715 kg.).

PERFORMANCE (estimated at 12,600 lb. = 5,715 kg. A.U.W.).—
Max. speed at S/L over 138 m.p.h. (222 km.h.).
Cruising speed at S/L over 104 m.p.h. (167 km.h.).
Max. rate of climb at S/L. 1,650 ft./min. (503 m./min.).
Hovering ceiling without ground effect 5,000 ft. (1,525 m.).
Hovering ceiling with ground effect 7,000 ft. (2,135 m.).
Ceiling (cruising) 6,000 ft. (1,830 m.).
Range 390 miles (630 km.).



The prototype Westland Wessex Naval Helicopter (Napier Gazelle engine).



The prototype Westland Wessex Naval Helicopter (1,430 s.h.p. Napier Gazelle shaft-turbine engine).

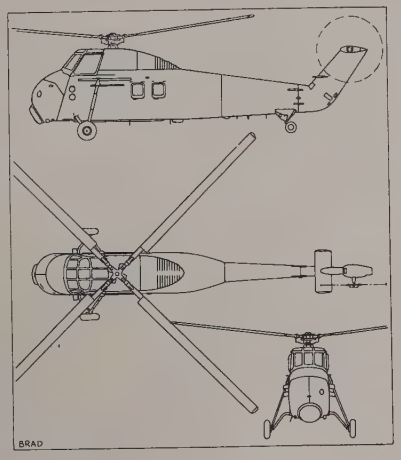
THE WESTLAND WESTMINSTER.

The name Westminster has been given to a new helicopter which is being developed by Westland as a private venture, using the main transmission, rotors and duplicated hydraulic control system of the Sikorsky S-56. Designed to meet a variety of civil and military rôles the Westminster will be capable of carrying 40 passengers and will have special freight-loading doors and hoisting facilities, with an external slinging point for loads that are too bulky to go inside its cabin.

Typical military loads will be 43 fully-equipped troops, or 31 stretcher cases, or four jeeps in an external sling.

The Westminster will be powered by two Napier Eland N.El.5 shaft-drive turbines mounted above the forward portion of the cabin, immediately in front of the gearbox for the five-blade main rotor. A four-blade tail anti-torque rotor will be fitted. Fuel capacity will be 920 Imp. gallons (4,180 litres).

The passenger cabin will be 35 ft. long, 10 ft. wide and 6 ft. 6 in. high (10.67 × 3.05 × 1.98 m.), with a volume of 1,780 cub. ft. (50.4 m.³). The rear freight



The Westland Wessex Helicopter.

compartment will have a capacity of 253 cub. ft. (7.16 m.³).

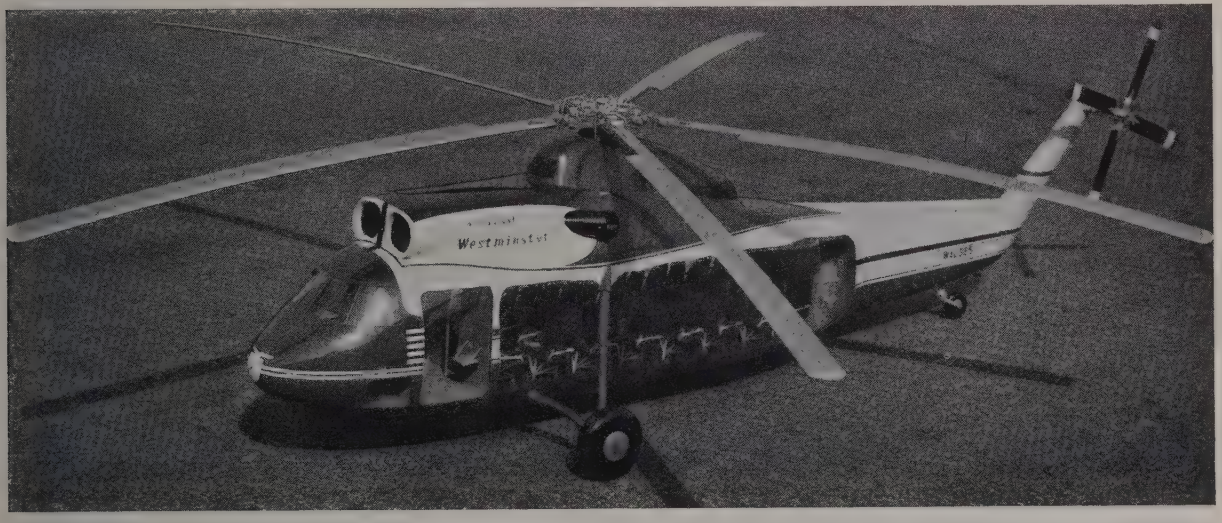
As a first step, Westland is building a simple steel-tube, fabric-covered version of the Westminster, embodying the basic rotor and mechanical components of the ultimate complete power-plant and transmission system. This version is expected to have an application as a "flying crane" vehicle for civil and military operations where weight lifting is a prior consideration.

The following data apply to the passenger-carrying version with full fuselage.

DIMENSIONS.—
- Diameter of main rotor 72 ft. (21.95 m.).
- Diameter of tail rotor 15 ft. (4.57 m.).
- Overall length 86 ft. 9 in. (26.42 m.).
- Overall height 21 ft. 1 in. (6.43 m.).

WEIGHTS.—
- Weight empty, equipped 20,000 lb. (9,072 kg.).
- Weight loaded 33,000 lb. (14,970 kg.).
- Overload max. weight 36,000 lb. (16,330 kg.).

PERFORMANCE (estimated).—
- Cruising speed at S/L. (70% M.E.T.O.) 150 m.p.h. (240 km.h.).
- Rate of climb at S/L. over 2,000 ft./min. (610 m./min.).
- Rate of climb at S/L. (one engine out) 600 ft./min. (183 m./min.).
- Vertical rate of climb at S/L. 600 ft./min. (183 m./min.).
- Range 489 miles (787 km.) in 3.3 hr. with 5,400 lb. (2,450 kg.) payload.
- Range 150 miles (240 km.) with 10,300 lb. (4,670 kg.) payload.



A model of the Westland Westminster which will be powered by two Napier Eland shaft-turbine engines.

AUSTRALIA

GOVERNMENT FACTORIES

DEPARTMENT OF DEFENCE PRODUCTION, DIVISION OF AIRCRAFT PRODUCTION.

Head Office: 8th Floor, 339 Swanston Street, Melbourne, Victoria.

Assistant Secretary (Aircraft Production): S. C. Weetman.

General Manager (Aircraft Factories): M. B. Woodfull.

Aircraft Factories: Fishermen's Bend (Headquarters), Melbourne, Victoria.

Airfield and Final Assembly Workshops: Avalon, Victoria.

Manager: N. W. Hodgson.

Chief Designer: I. B. Fleming.

Maintenance Branch: Fairfield, Melbourne, Victoria, and Parafield, South Australia.

Manager: M. A. W. Forestier.

Engine Factory: Lidcombe, New South Wales.

Managed by Commonwealth Aircraft Corporation Pty. Ltd.

Propeller Annexe: Alexandria, New South Wales.

Managed by de Havilland Aircraft Pty. Ltd.

Heavy Forge Annexe: Granville, New South Wales.

Managed by Australian Aluminium Company Pty. Ltd.

Production of the English Electric Canberra twin-jet bomber, powered with Rolls-Royce Avon engines, followed the completion during 1953 of the last of the 73 Avro Lincoln four-engined heavy bombers at the Australian Government Aircraft Factories. The first Australian-built Canberra B. Mk. 20 made its first flight on May 29, 1953. A structural description of the Canberra will be found under "English Electric."

Early in 1948 a series of meetings was held in London between representatives of the British Ministry of Supply and the Australian Department of Supply and Development to draft a specification covering the design and manufacture of a high-speed pilotless target aircraft for use in the guided missile development programme. This was issued in March, 1948 as Ministry of Supply Specification No. E7/48 and design work on the project began shortly after at the Government Aircraft Factories in Melbourne.

In order to reduce the overall development period, it was considered desirable that a piloted version should be designed concurrently with the pilotless to provide a human check on general flight characteristics and functioning of the remote controlling equipment.

The piloted variant, known as the Pika, was the first Australian-designed jet aircraft to take the air and has been described fully in previous editions of this annual. The pilotless version, the Jindivik, was the first remotely-controlled jet aircraft to be built in the British Commonwealth.

It was announced in 1956 that the Royal Swedish Air Board was interested in purchasing Jindivik aircraft and, subsequently, an order was received from this Board for 10 Jindiviks and associated ground equipment. Other enquiries have been received from overseas regarding the availability of the Jindivik, together with ground and flight control equipment.

Other guided weapon activities include development of the Malkara anti-tank missile, of which a quantity is being produced for service trials.

THE JINDIVIK TARGET DRONE.

Known initially as Project B, this pilotless target drone was later given the aboriginal name of Jindivik. A high degree of aerodynamic cleanliness was required to achieve the necessary performance, but the overriding considerations in its design were cheapness and simplicity of construction and ease of assembly and maintenance. These conflicting factors have resulted in more compromises than would be normal on a piloted aircraft, but on the whole the aerodynamics have not suffered unduly.

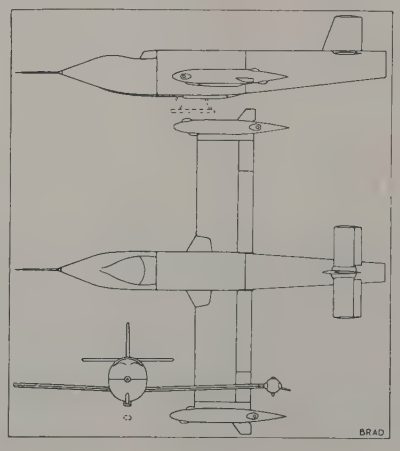
Jindivik Mk. 1. This initial version had an Armstrong Siddeley Adder ASA.1 turbojet. It first flew in August, 1952 and remained in production until 1954, when it was superseded by the Mk. 2. A full description of the Mk. 1 has appeared in earlier editions of "All the World's Aircraft."

Jindivik Mk. 2. One Armstrong Siddeley Viper short-life turbojet. This version is similar in layout to the Mk. 1 but the aerodynamically-controlled features have been revised to permit full advantage to be taken of the greater thrust provided by the Viper engine. At the same time, the structure has been considerably simplified to a degree consistent with its rôle as a target aircraft constructed essentially from the lower grades of aluminium-alloy materials. Demands on forgings, extrusions and machine fittings have been minimised, while castings and fabricated sheet items are used extensively. Advantage has been taken of Araldite bonding methods for many major assemblies.

The first prototype of the Mk. 2 made its first test flight on December 11, 1953, and the following details apply to this version:—

Type.—Pilotless Target aircraft.

Wings.—Mid-wing cantilever monoplane. Wing section NACA 64 Series with constant thickness-chord ratio of 6% and cambered to C.L. of 0.1. Aspect ratio 4.75. Heavy four-spar box structure between 20% and 60% of chord from aircraft C/L. to wing-tip, which is closed by cast sealing rib. No rivets used, the whole box being bonded with a thermo-setting adhesive to form an integral fuel tank. Light skinned, paper honeycomb-filled fairing completes the leading-edge. Trailing-edge is of light-skinned, two-spar and multi-rib construction, and has along its rear edge a piano hinge to carry flap and aileron. Ailerons and flaps are of fluted and folded skin construction with continuous piano hinge bonded in position. No air brake fitted, landing flap being used in its take-off position. Ailerons operated by electric servo-motor, flaps by electro-pneumatic system.



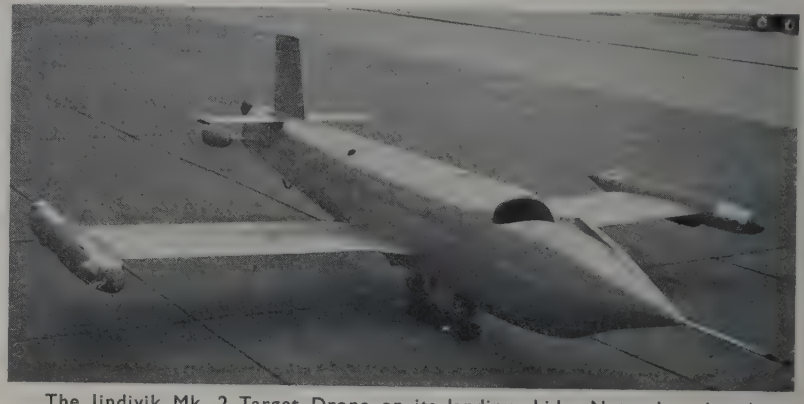
The Jindivik Mk. 2 Target Drone.

Fuselage.—Of light alloy in four main sections, front fuselage, equipment bay canopy, centre fuselage and rear fuselage. Front fuselage carries automatic pilot, radio control and telemetry equipment on three removable trays. Canopy lifts off for access. Centre fuselage has at its front end a large bay for special equipment required for target trials and the main fuel tank bay which contains a light crash-proof rubber bag tank, through which the air intake passes. Rear fuselage carries the engine and jet-pipe.

Tail Unit.—Cantilever monoplane type. Tailplane consists of four channel-section spars, central rib and end ribs, bonded to the skin by Araldite. Leading-edge is a single unsupported skin bonded to rebates in the forward edges of the under-spar skin. A continuous piano-type hinge bonded to the rear spar carries the elevators. Elevators are formed from a single wrapped sheet which is stabilised by chordwise flutes. Actuation is by an electrical servo-motor mounted under tailplane. Fin consists of a light gauge single skin bonded to a honeycomb core with an intermediate channel section spar. There is no rudder.

Landing Gear.—Retractable central skid with small subsidiary fixed skids under wing tips, nose and rear fuselage. Central skid is on a parallel linkage with an oleo-pneumatic shock absorber strut. As the skid is not used at take-off, the shock absorber strut is exhausted of air and manually raised to the retracted position, where it is held by a pneumatically-operated UP lock. On receipt of the radio signal "Undercarriage Down" air from the pneumatic system releases the UP lock and charges the shock absorber strut to extend it and thus lower the skid. At the same time air enters the flap jack and the flaps are lowered to the 20° position. To prevent damage to the flaps on landing, a mechanically-operated switch, attached to the landing skid, energises a release unit in the flap jacks and the flaps return to the streamline position. Prior to take-off, the flaps are manually set 20° down, returning to streamline at a predetermined speed after take-off.

Power Plant.—One Armstrong Siddeley Viper ASV.3 short life turbojet engine with a modified fuel system. Engine mounted in rear fuselage on two trunnions attached to the forward frame. An extractor duct surrounds the jet pipe, drawing cooling air through four flush intakes in the rear fuselage. Engine air intake is an NACA submerged type on top of the fuselage nose. Main fuel tank is an annular crash-proof bag of 63 gallons (286 litres) capacity surrounding the air intake duct. Additional fuel capacity provided by integral wing tanks of 16 gallons (73 litres) capacity each. Fuel system is pressurised from engine compressor, fuel from wing



The Jindivik Mk. 2 Target Drone on its landing skid. Note the wing-tip camera pods.

tanks feeding into main tank from where it is pumped to the engine. A pressurised recuperator tank of 1 gallon (4.5 litres) capacity caters for negative "G" conditions. Throttle is operated by an electrical linear actuator and the fuel off valve by a rotary actuator. For starting, compressed air from an external source is fed through a nozzle on to the engine turbine blades.

Electrical System.—Power for electrical services is drawn from an engine driven 6KW. D.C. generator with a regulated output of 27.5 volts. Generator supplies all requirements with relatively low capacity accumulators floating in the circuit. All main circuits are protected by auto resetting circuit breakers.

Remote-Control Equipment.—Control can be achieved from either a ground or airborne controlling station. Equipment consists briefly of a radio control receiver, units for interpreting external signals and applying them to control the aircraft, automatic pilot, and a telemetry transmitter for passing essential control information back to ground. In addition, a transponder is fitted to boost the radar response of the aircraft to increase the range over which it can be tracked. Notch aerials in fin leading-edge for radio receiver and telemetry transmitter.

Recording Equipment.—Cameras fitted with wide-angle lenses are mounted in pods on each wing-tip and are used to record the proximity of missiles fired against the target.

Take-off Trolley.—Tubular framework with tricycle wheel configuration. Framework carries three arms on which aircraft is mounted, two under the wings and one under the front fuselage, together with a tie-rod connected at one end to a release hook on the aircraft and at the other end to a brake cylinder on the trolley. When release is made, which is done automatically at a predetermined take-off speed, the arms collapse (with spring assistance) leaving the aircraft to fly off. At the same time brake cylinder applies pressure to the brakes on the rear wheels of the trolley. To keep the aircraft running straight during taxying, etc. the nose wheel is fitted with a servo steering mechanism monitored by a directional gyro.

Dimensions.—
Span (without wing-tip pods) 19 ft. (5.79 m.).
Span (with wing-tip pods) 23 ft. 7 in. (7.2 m.).
Length overall 23 ft. 3¾ in. (7.11 m.).
Height (static on skid to top of fin) 6 ft. 3½ in. (1.92 m.).

Weight.—
Weight loaded approx. 2,800 lb. (1,270 kg.).

Performance.—
Max. speed over 575 m.p.h. (925 km.h.).
Ceiling 50,000 ft. (15,250 m.).

COMMONWEALTH

COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.

Head Office and Works: Lorimer Street, Port Melbourne, Victoria.

Directors: L. Darling (Chairman), Essington Lewis, C.H., K. G. Begg, M. L. Baillieu, J. D. Bates, Sir Alexander Stewart, Sir Lawrence Wackett, D.F.C., A.F.C., B.Sc. (Manager), A. G. Brown (Secretary).

The Commonwealth Aircraft Corporation, Pty., Ltd., was formed in 1936 under a scheme propounded by the Australian Government for the establishment of an aircraft industry to make Australia independent of outside supplies.

The Corporation has an authorised capital of £2,000,000. The shareholders include the Broken Hill Proprietary Co. Ltd.; Broken Hill Associated Smelters Pty. Ltd.; Broken Hill South Ltd.; Electrolytic Zinc Co. of Australasia, Ltd; Imperial Chemical Industries of Australia and New Zealand, Ltd.; the Orient Steam Navigation Co. Ltd.; and Rolls-Royce Ltd.

Current products of the Corporation are the CA-25 Winjeel three-seat basic trainer, which is entering service with the R.A.A.F., and the Sabre fighter, which is being built under licence from North American Aviation, Inc.

The Australian-built Sabre is designated the CA-27 and is powered by the Rolls-Royce Avon turbojet engine, which is also being built at the Corporation's works at Fishermen's Bend.

Commonwealth has under development an agricultural aircraft, primarily for sale in Australia and New Zealand. To be known as the Ceres, it will be an all-metal low-wing monoplane with fixed landing gear and will be powered by a Pratt & Whitney R-1340 Wasp engine.

THE COMMONWEALTH CA-27 SABRE.

The Commonwealth Sabre, the prototype of which flew for the first time on August 3, 1953, is based on the North American F-86F and incorporates a considerable amount of local major re-design to allow it to be powered by the Rolls-Royce Avon engine of greater power and lighter installed weight. With the Avon consuming 25 per cent. more air than the J47, a much larger air inlet duct was necessary; and its lighter weight necessitated its re-positioning further aft in order to preserve the original C.G. positions. Structural re-design and the re-arrangement of internal equipment has resulted in only about 40 per cent. of the original fuselage structure being retained.

A heavier cannon armament has also been installed, and provision is made for the fitting of under-wing rockets and bombs.

The first production Avon-Sabre of a series of ninety was handed over to the R.A.A.F. on August 30, 1954.

Type.—Single-seat Fighter.

Wings.—Low-wing cantilever monoplane with 35° sweepback. Thin laminar-flow wing section. All-metal structure of sandwich type construction in which the structural material is laminated between the inner and outer tapered skins. No ribs in inboard halves of wing panels and skin is milled from ¼" material at roots. Fuel cells in centre-section and outboard wings. Auto slots on leading-edge. Slotted flaps. Irreversible power-operated aileron control system. Gross wing area 288 sq. ft. (26.8 m.²).

Fuselage.—Oval section all-metal structure with flush-riveted stressed skin. Speed brakes near rear of fuselage.

Tail Unit.—Cantilever monoplane type. All-metal structure. All surfaces have 35° sweep-back. 10° dihedral tailplane. Tailplane and elevators controllable and linked for co-ordinated movement. Pitch control is irreversible and power-operated. Artificial sensing system to give pilot a representative feel in absence of air loads.

Landing Gear.—Retractable tricycle type with steerable nose-wheel. Hydraulic retraction. Cleveland air-oil shock struts. Extra high-pressure tyres. Bendix multiple-disc hydraulic brakes in cast magnesium main wheels. Track 8 ft. 4 in. (2.5 m.).

Power Plant.—One Rolls-Royce Avon 20 axial-flow turbojet with straight ram air entry in nose of fuselage. Nose entry lipped above to maintain adequate air-flow in nose-up position. Main fuel tanks in fuselage. External long-range drop tanks may be carried under wings outboard of landing gear.

Accommodation.—Pressurised pilot's cockpit with sliding bubble canopy. Pilot ejection seat.

Armament and Equipment.—No details available.

Dimensions.—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

Weight.—
Weight loaded 17,000 lb. (7,710 kg.).

Performance.—
Max. speed 700 m.p.h. (1,125 km.h.).



The Commonwealth CA-27 Sabre Single-seat Fighter (Rolls-Royce Avon turbojet engine).

THE COMMONWEALTH CA-25 WINJEEL.

The CA-25, which first flew on February 23, 1955, is the production version of the CA-22, the prototype Winjeel, which made its maiden flight in 1950. The name Winjeel comes from an aboriginal word meaning Eagle.

TYPE.—Three-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23015 at root tapering to NACA 23009 at tip, with negative twist of 2½°. Aspect ratio 6. Mean chord 6 ft. 5 in. (1.96 m.). Dihedral (outer wings 5°). Two-spar aluminium-alloy structure. All-metal electrically-operated trailing-edge flaps between ailerons, including section beneath fuselage. Frise type ailerons have metal frames and fabric covering. Total flap area 33.61 sq. ft. (3.12 m.²). Total aileron area 13.78 sq. ft. (1.28 m.²). Gross wing area 249 sq. ft. (23.13 m.²).

FUSELAGE.— Aluminium - alloy semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Metal frames with metal-covered fixed surfaces and fabric-covered rudder and elevators. Elevators have trailing-edge servo and trim tabs. Rudder has trim-tab only. Areas: fin 9.42 sq. ft. (0.88 m.²), rudder 9.25 sq. ft. (0.86 m.²), tailplane 46.5 sq. ft. (4.32 m.²), elevators 20.19 sq. ft. (1.88 m.²). Tailplane span 14 ft. (4.27 m.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever long-stroke oleo-pneumatic shock-absorber struts. Dunlop wheels with hydraulic single-disc brakes. Free swivelling steerable tail-wheel. Track 10 ft. 1 in. (3.07 m.).

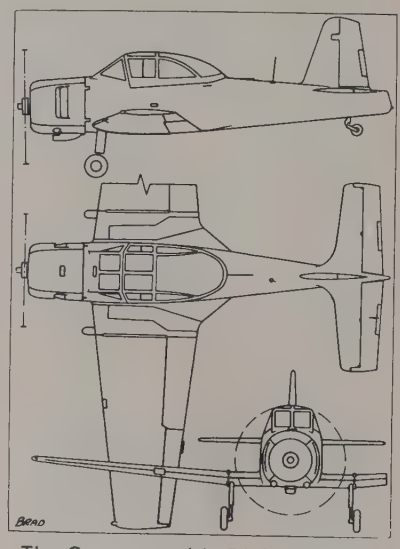
POWER PLANT.—One 445 h.p. Pratt & Whitney R-985-AN2 Wasp Junior nine-cylinder radial air-cooled engine on welded steel-tube mounting. Mounting attached to fireproof bulkhead by four bolts and quickly removable. Cowling in four opening panels hinged at the firewall for complete engine accessibility. Hamilton Standard two-blade variable-pitch airscrew. Two flexible bag tanks (34.5 Imp. gallons = 157 litres each) between spars in centre-section. Auxiliary fuselage tank may be carried beneath centre-section (30 Imp. gallons = 136 litres).

ACCOMMODATION.—Enclosed cockpit seats three, two side-by-side with dual controls in front plus third seat for additional pupil aft. Radio compartment beside rear seat. Sliding canopy may be jettisoned in emergency. Amber screening for blind flying training.

DIMENSIONS.—
Span 38 ft. 7½ in. (11.77 m.).



The Commonwealth CA-25 Winjeel (445 h.p. Pratt & Whitney R-985 engine).



The Commonwealth CA-25 Winjeel.

Length 28 ft. 0½ in. (8.55 m.).
Height 9ft. 1 in. (2.77 m.).

WEIGHTS AND LOADINGS.—
Weight empty 3,289 lb. (1,492 kg.).
Removable equipment 34 lb. (15 kg.).
Crew (2) 400 lb. (182 kg.).
Fuel (69 Imp. gallons) and oil (5 Imp. gallons) 542 lb. (246 kg.).
Weight loaded 4,265 lb. (1,935 kg.).
Wing loading 17.1 lb./sq. ft. (83.45 kg./m.²).
Power loading 9.58 lb./h.p. (4.34 kg./h.p.).

PERFORMANCE.—
Max. speed 186 m.p.h. (299 km.h.).
Cruising speed at 8,500 ft. (2,590 m.) 165 m.p.h. (265 km.h.).
Rate of climb at T.O. power 1,500 ft./min. (458 m./min.).
Rate of climb at rated power 1,130 ft./min. (344 m./min.).
Climb to 5,000 ft. (1,525 m.) at rated power 4.6 min.
Climb to 10,000 ft. (3,050 m.) at rated power 10 min.
Service ceiling 18,000 ft. (5,490 m.).
Stalling speed (flaps down) 53 m.p.h. (85 km.h.).
Stalling speed (flaps up) 62 m.p.h. (100 km.h.).
Take-off distance (standard temp.) 540 ft. (165 m.).
Take-off distance (tropical temp.) 630 ft. (192 m.).
Take-off distance to clear 50 ft. (15.25 m.) (standard temp.) 1,110 ft. (338 m.).
Take-off distance to clear 50 ft. (15.25 m.) (tropical temp.) 1,260 ft. (384 m.).
Landing distance from 50 ft. (15.25 m.) (standard temp.) 1,000 ft. (305 m.).
Cruising endurance (69 Imp. gal.) 3½ hours at 158 m.p.h. (253 km.h.) at 5,000 ft. (1,525 m.).

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT COMPANY (PTY.), LTD.

HEAD OFFICE AND WORKS: MILPERRA ROAD, BANKSTOWN, N.S.W.

President: Sir Geoffrey de Havilland. Directors: A. Murray-Jones (Chairman), W. E. Nixon, Lester J. Brain (Managing Director), D. H. McLachlan (General Manager), J. L. J. Byrne and R. J. Vicars.

The de Havilland Aircraft Pty., Ltd. was formed in Australia in 1927 to act as agents for the de Havilland Aircraft Co., Ltd., to build de Havilland aircraft under licence, to assemble new aircraft and to operate service stations for de Havilland products throughout Australia.

The de Havilland Vampire T. Mk. 35 jet trainer is currently in production at Bankstown. This version differs from earlier Marks in having greater range and non-skid type brakes. Current orders are for a total of 68 Vampires for the R.A.A.F., of which the last is scheduled for delivery in April, 1960. The company is also overhauling and repairing R.A.A.F. Vampires and R.A.N. Sea Venoms.

Since the production of Vampire Trainers began, complete overhaul facilities for the Goblin engine have been provided at the Bankstown factory. These jet engine overhaul shops also provide facilities for the Ghost engine which powers the Sea Venom carrier fighters in service with the Royal Australian Navy.

The Company's Propeller Division is situated in a factory at Alexandria, a suburb of Sydney. Guided weapons development is handled in another facility at Salisbury.

FAIREY

FAIREY AVIATION COMPANY OF AUSTRALASIA PTY. LTD.

REGISTERED OFFICE: 16, O'CONNELL STREET, SYDNEY, N.S.W.

WORKS: AIRPORT, BANKSTOWN, N.S.W.

POSTAL ADDRESS: P.O. Box 41, BANKSTOWN, N.S.W.

Chairman and Managing Director: Raymond E. Purves.
Engineering Manager: L. C. Williams.
Production Manager: F. O. Walker.
Secretary: J. R. Sainsbury.

This Company was founded in 1948 under the name of Fairey Clyde Aviation Co. Pty. Ltd. In November, 1951 the name was changed to Fairey Aviation Company of Australasia Pty. Ltd.

The Bankstown Works has carried out modifications, repairs and reconditioning of Fairey Firefly and Hawker Sea Fury aircraft of the Royal Australian Navy, and of Meteor T. Mk. 7 and F. Mk. 8 aircraft for the Royal Australian Air Force. During 1956, the Company began similar work on the Fairey Gannet A.S. Mk. 1 for the Royal Australian Navy.

In addition, overhaul of DC-3 and Dakota aircraft and components is in hand for Australian airlines, and agricultural conversion design and installations are being undertaken for Australian and New Zealand operators.

The Company is approved by both the Department of Defence Production and the Department of Civil Aviation for design and for all classes of aircraft repair and manufacture.

The Special Projects Division is located at Salisbury, South Australia, with Colonel R. T. Elvish as Manager. This Division is engaged on work in connection with the activities of the Rocket Range at Woomera, South Australia.

FAWCETT

FAWCETT AVIATION PTY. LIMITED.

HEAD OFFICE: P.O. Box 13, BANKSTOWN, SYDNEY, N.S.W.

Fawcett Aviation Pty. Ltd., a fixed-base operator, has built the prototype of a four-seat all-metal aircraft which was designed by Mr. Luigi Pellarini to a Fawcett specification for a trainer suitable for use by the Illawarra Flying School, a Fawcett subsidiary. Construction began in February, 1953 and the prototype made its maiden flight on November 11, 1954. Since June, 1956 the aircraft has been undergoing development flying and evaluation testing, and at the time of writing was due to go to the R.A.A.F. Aircraft Research and Development Unit for Type Approval tests.

THE FAWCETT 120.

TYPE.—Four-seat Trainer.

WINGS.—High-wing braced monoplane. Aluminium-alloy (DTD390) single-spar structure with smooth stressed-skin covering. Single wood-faired steel tube bracing strut on each side. All-metal manually-operated flaps and ailerons are interchangeable. Gross wing area 185 sq. ft. (17.19 m.²).

FUSELAGE.—Aluminium-alloy (DTD390) monocoque structure, in two main sections. Fin integral with rear section.

TAIL UNIT.—Braced monoplane type. Aluminium-alloy structure with metal skinning throughout. Tailplane braced to fuselage by single strut each side.

LANDING GEAR.—Tricycle type. Main cantilever struts are hinged at lower edges of fuselage and extensions of legs within fuselage are attached to transverse shock-absorbers. Castoring nose-wheel leg also sprung within fuselage. Main wheels have mechanically-operated (hydraulic in production aircraft) brakes.

POWER PLANT (Prototype).—One 130 h.p. D.H. Gipsy Major Series I four-cylinder in-line inverted air-cooled engine driving wood two-blade fixed-pitch airscrew. Two fuel tanks (12½ Imp. gallons each) in wing roots. Total fuel capacity 25 (34 in production aircraft) Imp. gallons (113.6 litres). Airframe stressed for engines up to 180 h.p.

ACCOMMODATION.—Enclosed cabin seating four in two pairs. Large entry door on each side. Access to rear cross-bench seat by tilting backs of front seats. Front seats have dual controls. Aircraft is fully aerobatic with two occupants and at A.U.W. of 1,700 lb. (770 kg.).

DIMENSIONS.—
- Span 35 ft. 8 in. (10.87 m.).
- Length 22 ft. 8 in. (6.91 m.).
- Height 6 ft. 9 in. (2.06 m.).

WEIGHTS AND LOADINGS.—
- Weight loaded (prototype) 2,000 lb. (907 kg.).
- Weight loaded (production) 2,350 lb. (1,066 kg.).
- Weight loaded (aerobatic) 1,700 lb. (770 kg.).
- Wing loading (prototype) 10.9 lb./sq. ft. (53.2 kg./m.²).
- Power loading (prototype) 15.4 lb./h.p. (7.0 kg./h.p.).

PERFORMANCE (prototype).
- Max. speed 127 m.p.h. (204 km.h.).
- Cruising speed 107 m.p.h. (172 km.h.).
- Rate of climb at S/L. 600 ft./min. (183 m./min.).
- Service ceiling 14,600 ft. (4,450 m.).
- Cruising endurance 3½ hours.

KINGSFORD SMITH



The first skeleton assembly of the Kingsford Smith PL-7 Tanker (400 h.p. Armstrong Siddeley Cheetah engine).

KINGSFORD SMITH AVIATION SERVICE PTY., LIMITED.

HEAD OFFICE AND WORKS: BANKSTOWN AERODROME, BANKSTOWN, SYDNEY.

Directors: J. T. Brown, A.F.R.Ae.S., A.M.I.Mech.E. (Managing), P. G. Brown, D.F.C. and J. E. Smith.

Chief Designer: L. Pellarini.

Kingsford Smith Aviation Service was formed in 1946 from the original Kingsford Smith Air Service which was built up in 1935 by Sir Charles Kingsford Smith. Since the War, the company has been actively concerned with the sales, service and overhaul of light and medium aircraft, and the development of light aircraft for Australia's outback conditions.

Early in 1955, the company embarked upon the prototype production of a design to meet the requirements of operators in Australia and New Zealand for a medium-sized agricultural aircraft.

THE KINGSFORD SMITH PL-7 TANKER.

TYPE.—Single-seat Agricultural Biplane.

WINGS.—Single-bay unequal-span staggered biplane. NACA 6212 wing section. Aspect ratio 6.8 (upper), 6 (lower). Incidence 4° (upper), 3° (lower). Lower wings, attached to hopper, have two welded steel tube spars, welded steel tube ribs and light alloy leading edges. Upper wing has light alloy torsion box spar and steel tube ribs. Wings are fabric covered. Streamlined steel tube strut bracing. Frise-type ailerons in upper wings. Lower wings incorporating built-in spray booms. Total area of ailerons (2) 21.6 sq. ft. (2.0 m.²). Gross wing area 255 sq. ft. (23.68 m.²) upper, 150 sq. ft. (13.93 m.²) lower, total 405 sq. ft. (37.61 m.²).

FUSELAGE.—Mild steel tank of welded construction serves as the main fuselage structure and the hopper. Steel tube cockpit section, metal covered, bolted to rear face of tank unit.

TAIL UNIT.—Steel-tube fabric-covered structure incorporating twin fins and rudders mounted below, and braced to a single tailplane. The tailplane is mounted on the extremities of two tubular steel cross-braced booms which project from the upper wing centre-section and are braced to the fuselage tank structure. Areas: tailplane and elevator (total) 64 sq. ft. (5.95 m.²), fin and rudder (total) 24 sq. ft. (2.23 m.²). Span of tailplane 18 ft. 3½ in. (5.58 m.).

LANDING GEAR.—Fixed tricycle type. Goodyear main and nose wheels. Hydraulic toe-operated brakes on main wheels with nose-wheel steering from rudders. Rubber-in-torsion suspension is used throughout. Track: 11 ft. (3.35 m.).

POWER PLANT.—One 400 h.p. Armstrong Siddeley Cheetah X seven-cylinder air-cooled radial engine driving a Fairey-Reed fixed-pitch metal two-blade propeller. Provision is made for engines of up to 600 h.p. driving constant-speed propellers. Fuel tank in rear fuselage section below pilot. Fuel capacity 50 Imp. gallons (227 litres). Two 70 Imp. gallon (318 litres) auxiliary fuel tanks, carried under wings, can also be used to contain spray chemicals. Oil capacity 7 Imp. gallons (31.8 litres).

ACCOMMODATION.—Enclosed cockpit with sliding canopy in rear fuselage section, stressed to withstand forward load of 60 g. Points of attachment for pilot's safety harness designed to withstand load of 45 g. Second person can be accommodated in hopper for ferrying.

EQUIPMENT. Hopper for fertiliser, dust, seed or liquid forming main fuselage structure ahead of cockpit. Hopper outlet is designed for the rapid interchange of base plate carrying either fertiliser louvres, seeding or dusting gates, or air-driven pump and distributors for spraying. Spray booms are built into the trailing edges of lower wings with provision for varying numbers of spray nozzles. Tank is plastic-lined and suitable for both solid and liquid loads. Capacity 45 cub. ft. (1.274 m.³).

DIMENSIONS.—
- Span (upper) 40 ft. 9½ in. (12.44 m.).
- Span (lower) 30 ft. (9.14 m.).
- Length 24 ft. 6 in. (7.47 m.).
- Height 10 ft. (3.05 m.).

WEIGHTS (designed).—
- Weight empty 2,220 lb. (1,007 kg.).
- Weight loaded 5,000 lb. (2,270 kg.).

PERFORMANCE (estimated, with full load at S/L.).—
- Max. speed 127 m.p.h. (203 km.h.).
- Cruising speed 112 m.ph. (179 km.h.).
- Operating speed 70-90 m.p.h. (113-182 km.h.).
- Landing speed 35 m.p.h. (56 km.h.).
- Rate of climb 740 ft./min. (225 m./min.).
- Service ceiling 12,800 ft. (3,900 m.).
- Cruising range 340 miles (547 km.).
- Take-off distance to 50 ft. (15.25 m.) 1,425 ft. (435 m.).
- Landing distance from 50 ft. (15.25 m.) 420 ft. (128 m.).

MOLYNEUX

THE MOLYNEUX HELICOPTER CO., PTY., LTD.

HEAD OFFICE AND WORKS: MELBOURNE AIRPORT, VICTORIA.

Directors: G. C. Molyneux, B.E., A.F.R.Ae.S., M.I.Ae.S., A.M.I.E. (Australia) and P. M. Molyneux.

This company was formed in November, 1953, with an authorised capital of £100,000, to design and develop a tandem-rotor helicopter, with particular attention to a rotor head design which will eliminate severe oscillation in the plane of rotor rotation when the tip path plane is tilted in relation to the shaft. This rotor head is now patented.

Initially, this development work was carried out in conjunction with the Aeronautical Research Laboratories of the Australian Department of Supply, where a powered model of the projected XM-1000 helicopter was flown virtually on a universal joint.

Subsequently, it was decided to build a small two-seat helicopter of 1,600 lb. (725 kg.) loaded weight to flight test the patented rotor head.

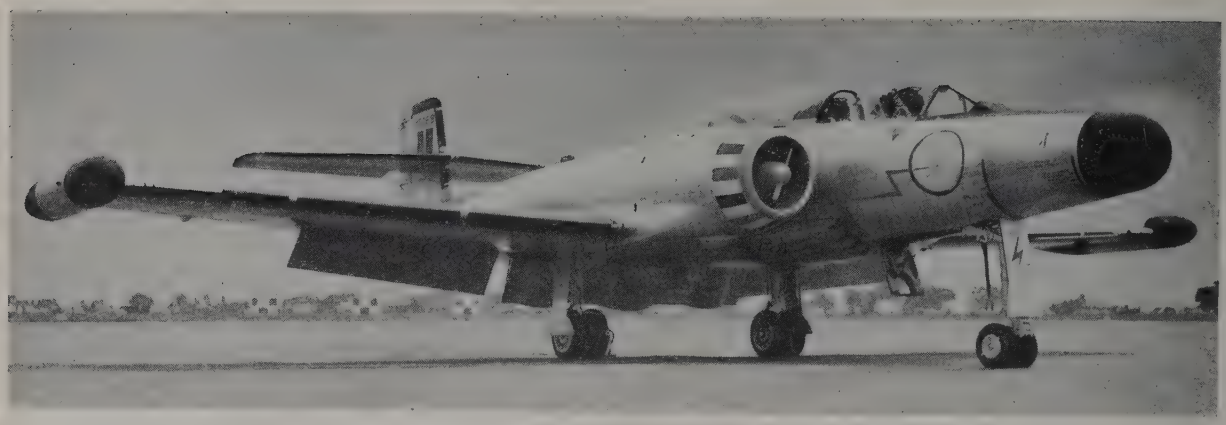
THE MOLYNEUX XM-1000.

The XM-1000 will be a five-seat tandem-rotor helicopter using two identical three-blade rotors, one forward above the cabin and one aft on a pylon.

Powered by a 550 h.p. Pratt & Whitney Wasp engine, the XM-1000 is designed to have a range of 350 miles (565 km.) at a loaded weight of 4,000 lb. (1,815 kg). No other details are available.

CANADA

AVRO



The Avro CF.100 Mk. 4A Two-seat All-weather Fighter (two Orenda 9 turbojet engines) with wing-tip rocket pods.

AVRO AIRCRAFT LIMITED.

HEAD OFFICE AND WORKS: MALTON, NEAR TORONTO, ONT.

POST OFFICE ADDRESS: BOX 4004, TERMINAL "A", TORONTO, ONT.

Chairman: Crawford Gordon, Jr.

President and General Manager: F. T. Smye.

Vice-President—Engineering: J. C. Floyd.

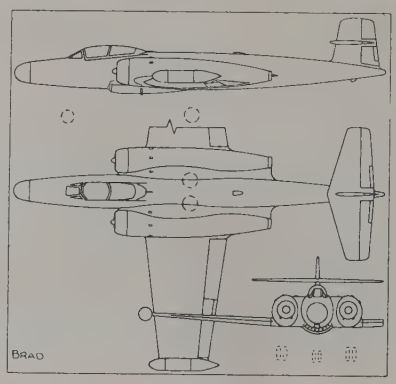
Vice-President—Manufacturing: H. R. Smith.

Vice-President—Sales and Service: J. A. Morley.

Vice-President — Finance: J. Turner.

A. V. Roe Canada, Ltd., a member of the Hawker Siddeley Group, was formed in 1945 when it took over the Malton plant of the Government-owned Victory Aircraft, Ltd. This organisation eventually expanded into two divisions, one concentrating on airframes and the other on gas-turbine engines.

To meet the growing complexities and divergent airframe and aero-engine demands the two divisions have now been incorporated as separate companies with A. V. Roe Canada, Ltd., as the parent corporation.



The Avro CF.100 Mk. 4.

The Aircraft Division has been operating as a separate corporate entity under the name of Avro Aircraft, Ltd. since January 2, 1955.

Currently in production is the CF.100 twin-jet long-range all-weather fighter, which is now in R.C.A.F. squadron service throughout Canada. In the Autumn of 1956 the first of four squadrons of CF.100 Mk. 4B's flew to France to augment the R.C.A.F. fighter squadrons there and to meet a specific N.A.T.O. requirement for night fighters. The remaining squadrons will be in service in Europe before the end of 1957.

The successor to the CF.100 will be the CF.105 supersonic delta-wing all-weather fighter, of which the first pre-production model was expected to fly in 1957.

THE AVRO CF.105 ARROW.

Avro has received a contract for the development and construction of the CF.105 twin-jet delta-wing all-weather fighter.

Two versions of the Arrow have been announced:—

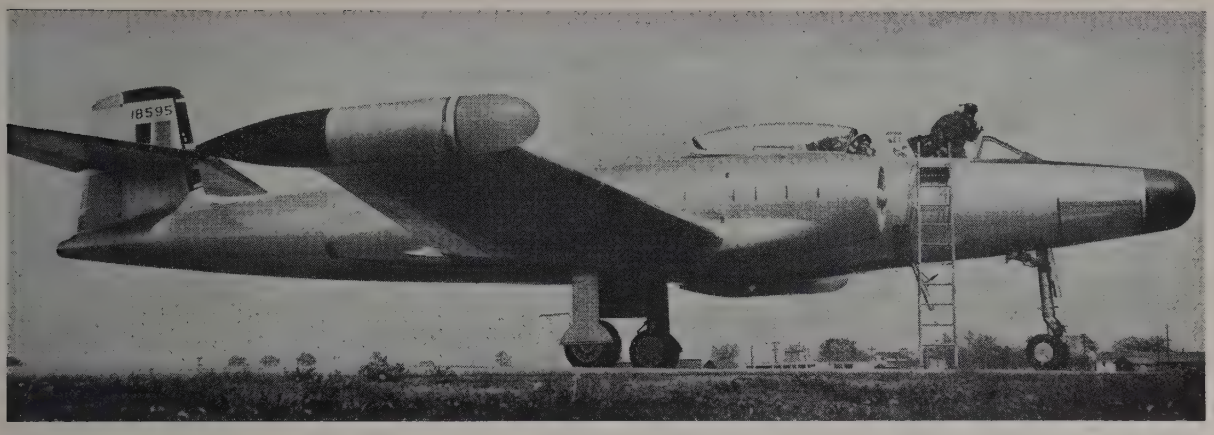
Arrow Mk. 1. First six aircraft, each powered by two Pratt & Whitney J75 turbojet engines with afterburners.

Arrow Mk. 2. Developed version with two Orenda Iroquois turbojet engines. Armed with Douglas-Canadair Sparrow II air-to-air missiles.

The first prototype Arrow was due to be rolled out of the Avro factory at Malton on October 4, 1957.



The Avro CF.100 Mk. 4B (two Orenda 11 turbojet engines) in N.A.T.O. camouflage finish.



The Avro CF.100 Mk. 5 Two-seat All-weather Fighter (two Orenda 11 turbojet engines).

THE AVRO CF.100.

The CF.100 two-seat long-range all-weather fighter, which was designed to the requirements of the Royal Canadian Air Force, was the first aircraft to be wholly designed and built in Canada. By exceeding Mach 1 in a dive from 30,000 ft. (9,150 m.) on December 18, 1952, the CF.100 achieved the distinction of being the first straight-wing combat aircraft to exceed the speed of sound. It is now in large-scale production for the Royal Canadian Air Force and the Belgian Air Force, the current production version being the Mk. 5. More than 600 have been built.

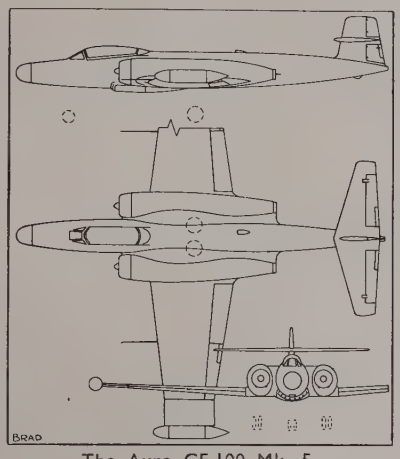
Some CF.100's have been equipped for "collision course" target towing. The towing hook is contained in an extended tail-cone, and they have an all-over coat of luminous red paint as a safety precaution.

The following are the principal versions of the CF.100 :—

Mark 1. Two Rolls-Royce Avon turbojet engines. Two prototypes built. First Mk. 1 flew for the first time on January 19, 1950.

Mark 2. Two Orenda turbojet engines. Pre-production unarmed model. Ten built. First Mk. 2 flew on June 20, 1951. One Mk. 2T with dual controls.

Mark 3. Two Orenda 9 turbojet engines. First production series. Seventy built. Armament : eight 0.50 in. (12.7 mm.) machine-guns in easily-replaceable ventral tray. First Mk. 3 flew on October 11, 1952. Fifty being converted into dual-control trainers under designations Mk. 3CT and Mk. 3D.



The Avro CF.100 Mk. 5.

Mark 4. Two Orenda 9 (Mk. 4A) or Orenda 11 (Mk. 4B) turbojet engines. Longer fuselage and revised nose shape. Armament consists of both 0.50 in. (12.7 mm.) machine-guns and rockets. Rocket armament carried in wing-tip containers. Hughes MG-2 fire control system. Increased performance. Prototype Mk. 4 flew on October 11, 1952, and the first production Mk. 4 on October 24, 1953.

Mark 5. Two Orenda 11 turbojet engines. Development of Mk. 4 with additional wing and tailplane area for improved performance at high altitude. Fuselage gun-pack deleted. First production Mk. 5 flew on October 12, 1955.

Mark 6. Similar to Mk. 5 but with provision for carrying four Canadian-built Sparrow II air-to-air missiles and for afterburning.

The description which follows refers in the main to the CF.100 Mk. 5.

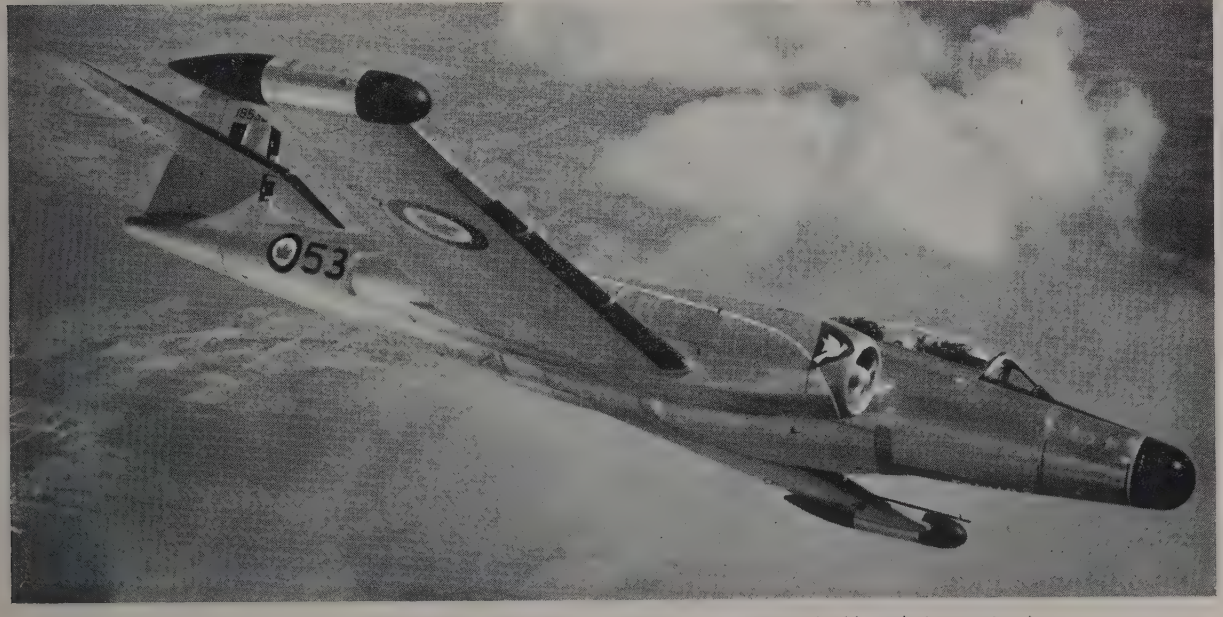
TYPE.—Two-seat Long-range All-weather Fighter.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 0010. Aspect ratio 5.9. Chord at root 13 ft. 11 in. (4.24 m.), at tip 7 ft. 2½ in. (2.20 m.). Dihedral at datum 3°. Sweepback 5.69° on leading-edge. All-metal structure with split flaps on centre-section and plain flaps on outer wings. Total aileron area (including tabs) 28.6 sq. ft. (2.65 m.²). Total area of flaps 65.7 sq. ft. (6.10 m.²). Dive-brake area (total of four) 41.76 sq. ft. (3.88 m.²). Gross wing area 591 sq. ft. (54.91 m.²).

FUSELAGE.—All-metal flush-riveted semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Tailplane mounted halfway up fin. All-metal structure. Areas : fin 35.3 sq. ft. (3.28 m.²), rudder 11.62 sq. ft. (1.08 m.²), elevator 27.15 sq. ft. (2.52 m.²), tailplane 98.4 sq. ft. (9.14 m.²). Tailplane span 25 ft. (7.62 m.).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Dowty liquid-spring shock-absorber struts. Dunlop wheels and



The Avro CF.100 Mk. 5 Two-seat All-weather Fighter (two Orenda 11 turbojet engines).

Dunlop brakes on main wheels. Track 10 ft. 2 in. (3.10 m.). Wheelbase 18 ft. 1½ in. (5.52 m.).

POWER PLANT.—Two Orenda Series 11 axial-flow turbojet engines (over 7,000 lb. = 3,180 kg. s.t. each).

ACCOMMODATION.—Pressurised cockpit seating two in tandem, pilot in front, navigator/radar-operator behind. Sliding jettisonable canopy. Martin Baker ejection seats for both members of crew.

DIMENSIONS.—
Span 60 ft. 10 in. (18.54 m.) over rocket pods.
Length 54 ft. 2 in. (16.5 m.).
Height 14 ft. 6 in. (4.42 m.).

WEIGHTS.—
Weight loaded approx. 33,600 lb. (15,240 kg.).

PERFORMANCE.—
No data available.

BRISTOL

THE BRISTOL AEROPLANE COMPANY OF CANADA (1956), LTD.

HEAD OFFICE: INTERNATIONAL AVIATION BUILDING, MONTREAL 3, QUEBEC.

Directors: Sir Reginald Verdon Smith (Chairman); R. J. Reynolds (President); P. P. Hutchinson, Q.C.; J. N. Baird; Air Cdre. F. R. Banks, C.B., O.B.E.; R. G. B. Dickson; W. S. Haggett; W. R. C. Patrick; Air Vice-Marshal A. L. James.

Secretary: B. A. Chalmers.

Treasurer: J. A. Limoges.

The Bristol Aeroplane Company of Canada, Ltd., is the head office for the Canadian group of Bristol companies, which includes Bristol Aircraft (Western), Ltd., Bristol Aero Engines, Ltd., and Bristol Aero Engines (Western), Ltd.

BRISTOL AIRCRAFT (WESTERN) LTD.

HEAD OFFICE AND WORKS: STEVENSON FIELD, P.O. BOX 874, WINNIPEG.

Directors: Sir Reginald Verdon Smith (Chairman); R. J. Reynolds (President); W. S. Haggett (Vice-President and General Manager); R. G. B. Dickson; G. Lawson.

Secretary: R. G. Small.

Originally known as MacDonald Bros. Aircraft, Bristol Aircraft (Western) Ltd. is the largest and most important of the Bristol group's operating companies in Canada.

Current production includes engine nacelles and other components for the CS2F-1 aircraft being built by de Havilland Aircraft of Canada, tail-cone assemblies and jet-pipes for Orenda engines, and Edo floats under licence for the de Havilland and Cessna companies. In addition, large contracts are held for the repair and overhaul of Beech Expeditors and Avro CF-100 fighters.

A helicopter design team, trained at the parent company's factory in England, will be based at Winnipeg, where it is hoped eventually to undertake the design and production of rotating wing aircraft.

CANADAIR

CANADAIR LIMITED.

HEAD OFFICE AND WORKS: CARTIERVILLE AIRPORT, MONTREAL, P.Q.

POSTAL ADDRESS: P.O. Box 6087, MONTREAL, P.Q.

Chairman of the Board: Frank Pace, Jr.

President and General Manager: J. Geoffrey Notman.

Vice-Chairman of the Board: Earl D. Johnson.

Vice-Chairman of the Board: Lawrence B. Richardson.

Assistant to the Chairman of the Board—Finance: Lambert J. Gross.

Assistant to the Chairman of the Board—Legal Affairs: Roger I. Harris.

Assistant to the Chairman of the Board—Planning: Allen D. Marshall.

Assistant to the Chairman of the Board—Communication: Vernon M. Welsh.

Vice-President and General Counsel: John E. L. Duquet, Q.C.

Vice-President—Engineering: William K. Ebel.

Vice-President—Manufacturing: Dean P. Stowell.

Vice-President—Sales: Peter H. Redpath.

Vice-President and Comptroller: James F. Tooley.

Secretary and Treasurer: John Urwin.

Assistant to President: Frederick R. Kearns.

Director of Public Relations: Gordon J. Stringer.

Assistant Comptroller Theodore C. Pawlett.

Canadair originated from the pioneer aircraft design and manufacturing company in Canada, Canadian Vickers Limited, and became an independent entity in 1942. It was acquired by General Dynamics Corporation in 1946, and is now engaged on the development and production of aircraft, missiles, atomic energy equipment and snowmobile-type cargo and personnel carriers.

The first CL-28 Argus maritime reconnaissance aircraft, developed by Canadair from the Bristol Britannia transport, made its first flight on March 28, 1957, and a total of eight of these aircraft was scheduled to be delivered to the R.C.A.F. during the year.

In addition, Canadair re-entered the commercial aviation field in 1957 when it signed an agreement with the Bristol Aeroplane Company, Ltd. under which it acquired extensive rights for the production and sale of a Canadian derivative of the Britannia known as the CL-44. This will be available in civil airliner, freighter and military transport versions, all powered by Bristol Orion turboprop engines. The Canadian Government has ordered eight of the military transport versions for the R.C.A.F. and production of these has already started.

Canadair continued quantity production of the Sabre 6 for the West German Air Force during 1957, and also completed its production of 1,500 of these aircraft for the R.C.A.F. Manufacture of the T-33 Silver Star jet trainer was continued for the R.C.A.F., but at a reduced rate.

By the end of 1957, it was expected that almost 1,700 Sabres of various marks would have been produced by Canadair for the R.C.A.F., U.S.A.F. and the air forces of South Africa, Colombia, Germany, Greece, Turkey, Italy and Yugoslavia. By the same date, more than 600 T-33's were due to have been produced for use as standard trainers by the R.C.A.F. and the NATO training programme in Canada.

Canadair continued its active association with Canada's guided missile programme during the year, but no details of this work are available, except that it includes development in Canada of the Douglas Sparrow II air-to-air missile. It also completed a nuclear reactor and a beta ray spectrometer for Atomic Energy of Canada Ltd.

An unusual project for an aircraft company was the design and development of an original Canadian Army concept of an articulated tracked vehicle, intended for use as a snowmobile in the far North, but equally effective on sand, swamp, muskeg and in water. Canadair was chosen by the Army to build a series of these vehicles, which are known as Rats, primarily because of its experience in producing lightweight structures, and because a requirement was that the Rat should be suitable for dropping from the air by parachute.

The company's plant at Cartierville Airport has a covered floor area of 2,750,000 sq. ft. and new extensions are in the planning stage. Approximately 11,200 persons were employed there at the end of 1957. In addition, there is a South American subsidiary company known as Canadair International Ltd., at Bogota, Colombia.



The Canadair CL-28 Argus Maritime Reconnaissance Monoplane (four 3,700 h.p. Wright R-3350 Turbo Compound engines).



The Canadair CL-28 Argus Maritime Reconnaissance Monoplane (four 3,700 h.p. Wright R-3350 Turbo Compound engines).

THE CANADAIR CL-44.
R.C.A.F. designation: CC-106.

The CL-44 transport will be a derivative of the Bristol Britannia airliner, powered by four Bristol Orion turboprop engines, driving de Havilland aluminium-alloy four-blade constant-speed feathering reverse-pitch airscrews, diameter 16 ft. (4.88 m.). It will be available as a civil or military passenger transport or freighter and will have a maximum range of approximately 5,000 miles (8,050 km.) at a cruising speed of about 400 m.p.h. (645 km.h.). This will be sufficient for non-stop operation across the Atlantic in either direction regardless of headwinds.

An order for eight CL-44 transports for the R.C.A.F. was announced in the Spring of 1957, and when delivery of these aircraft begins in 1959 they are expected to replace the Canadair North Stars at present in service with the R.C.A.F. Air Transport Command.

Designated CC-106 by the R.C.A.F., the military version of the CL-44 will accommodate approximately 120 passengers, or 45,000 lb. (20,410 kg.) of cargo, or a combination of both.

DIMENSIONS.—
Span 142 ft. 3½ in. (43.38 m.).
Length 124 ft. 3 in. (37.89 m.).
Height 36 ft. 8.3 in. (11.19 m.).

THE CANADAIR CL-28 ARGUS.
R.C.A.F. designation: CP-107.

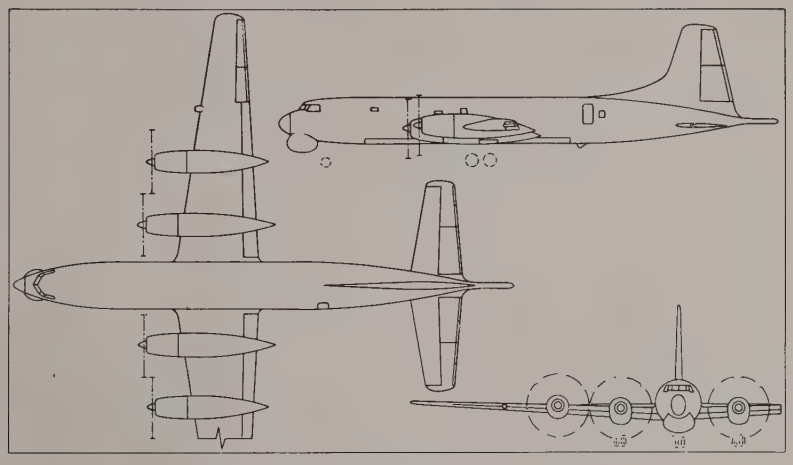
The CL-28 Argus is a modification of the basic design of the Bristol Britannia to meet R.C.A.F. requirements for a long-range maritime reconnaissance aircraft and is the largest aircraft ever built in Canada.

It retains the principal aerodynamic and structural features of the Britannia. Except for U.S. standardisation, the wings, tail surfaces, landing-gear and primary flight controls of the Britannia remain substantially unchanged. The fuselage, while structurally similar, is unpressurised and is considerably modified both internally and externally.

The forward fuselage includes an observation or low-level bombing station, a large radome beneath the nose and a new forward crew compartment. Bomb-bays are provided forward and aft of the wings.

One modification to the wings is the addition of a small spoiler on the upper surface of each panel, inboard of the ailerons, to meet the requirement for a high rate of roll at low altitudes.

The power-plant consists of four 3,700 h.p. Wright R-3350 Turbo Compound engines, driving 15 ft. 6 in. (4.72 m.) Curtiss Electric three-blade airscrews, because the maritime reconnaissance rôle demands long-range operation at very low levels where a propeller-turbine power-plant would be unsuitable. The maximum fuel capacity of the Argus is 6,800 Imp. gallons (30,910 litres) which makes possible a maximum endurance of 24 hours at reconnaissance altitudes and speeds.



The Canadair CL-28 Argus Maritime Reconnaissance Monoplane.

The Argus carries a crew of fifteen, consisting of three pilots, three navigators, two flight engineers and seven communications and electronics operators. There is provision for the carriage of the most up-to-date anti-submarine weapons and stores, together with 21 radio and radar installations, including search radar under the nose, an MAD (magnetic airborne detector) installation in a tail "sting" and ANTAC (air navigation and tactical air control), specially developed for the Argus by Computing Devices of Canada.

The maximum all-up weight of the Argus (148,000 lb. = 67,130 kg.) is slightly less than that of the Britannia Series 100.

Work on the Argus began in April, 1954. Since that time all wing and tail surface structural drawings have been re-drawn to American standards and North American equivalents have been established for all materials and parts. The first Argus came off the assembly line on December 21, 1956 and flew, three days ahead of schedule, on March 28, 1957. Eight more were due for completion in 1957, when orders in hand covered a total of 25 aircraft. The Argus is expected to enter service with the R.C.A.F. Maritime Air Command early in 1958.

DIMENSIONS.—
Span 142 ft. 3½ in. (43.38 m.).
Length 128 ft. 3 in. (39.09 m.).
Height 36 ft. 8½ in. (11.19 m.).

PERFORMANCE.—
Max. speed over 290 m.p.h. (467 km.h.).
Cruising speed 175-200 m.p.h. (282-322 km.h.).
Service ceiling over 20,000 ft. (6,100 m.).
Range over 4,000 miles (6,440 km.).

THE CANADAIR SABRE.

The Canadair Sabre is built under licence from North American Aviation, Inc. and production began in 1949 for the R.C.A.F.

The following are the principal versions of the Canadair Sabre :—

Sabre Mk. 1. Prototype only. Based on the F-86A. First flew on August 9, 1950.

Sabre Mk. 2. First production version for the R.C.A.F. Based on the F-86E with "all-flying" tail and powered by the General Electric J47 turbojet engine obtained from the U.S.A.

Sabre Mk. 3. Mk. 2 fitted with the Orenda 10 engine (6,500 lb. = 2,950 kg. s.t.). Prototype for the Mk. 5. First flew early in 1953. This aircraft flown by Miss Jacqueline Cochran established three World's records in May, 1953, the 15-kilometre straight-away speed record at 675.069 m.p.h. (1,087.068 km.h.); the 100-kilometre closed-circuit speed record at 652.163 m.p.h. (1,050.182 km.h.); and the 500-kilometre closed-circuit speed record at 589.969 m.p.h. (950.032 km.h.).

Sabre Mk. 4. Later production version of the Mk. 2, for the Royal Air Force.

Sabre Mk. 5. Powered by the Orenda 10 engine (6,500 lb. = 2,950 kg. s.t.) and fitted with the 6/3 wing first used by the F-86F. First production Mk. 5 flew on July 30, 1953.

Sabre Mk. 6. Development of Mk. 5 with higher-powered Orenda 14 engine with two-stage turbine (7,200 lb. = 3,270 kg. s.t.) and re-designed slatted wing leading-edge. Primarily a high-altitude fighter but can be used for ground attack with bombs and rockets. For bomber interception guided weapons may be



The Canadair Sabre Mk. 6 Single-seat Fighter (Orenda 14 turbojet engine).

carried. Standard equipment of R.C.A.F. No. 1 Air Division in Europe in 1955-57.

By October, 1957, more than 1,600 Canadair Sabres had been built and supplied to the R.C.A.F., R.A.F., U.S.A.F. and the Greek, Turkish, Italian, South African, Colombian and West German Air Forces.

A general description of the Sabre will be found under "North American" (U.S.A.), but details of the latest versions of the Canadian-built Sabre are not available for publication.

DIMENSIONS (Sabre Mk. 6).—
Span 37 ft. 1½ in. (11.32 m.).
Length 37 ft. 6 in. (11.43 m.).
Height 14 ft. 9 in. (4.49 m.).

THE CANADAIR SILVER STAR.

The Silver Star, which is being built under a licence from the Lockheed Aircraft Corporation, is the T-33A two-seat jet trainer powered by a Rolls-Royce Nene 10 turbojet engine (5,100 lb.=2,315 kg. s.t.). Canadair is manufacturing a substantial quantity for the R.C.A.F. The first Nene-powered Silver Star flew for the first time in October, 1952, and the first production aircraft was delivered to to the R.C.A.F. in January, 1953. By the Autumn of 1957 more than 600 had been produced.

DIMENSIONS.—
Span 42 ft. 5 in. (12.93 m.).
Length 37 ft. 8 in. (11.48 m.).
Height 11 ft. 8 in. (3.55 m.).

CAN-CAR

CANADIAN CAR COMPANY, LTD.

HEAD OFFICE: 621, CRAIG STREET WEST, MONTREAL 3, P.Q.

AIRCRAFT WORKS: FORT WILLIAM, ONTARIO.

President and Managing Director: A. C. MacDonald.

Vice-President in charge of Manufacturing, Aircraft Division: R. E. Henderson.

Vice-President in charge of Sales, Aircraft Division: L. H. Kottmeier.

Vice-President, Export Division: A. C. Lawson.

Vice-President (Finance) and Treasurer: J. E. Chubb.

Secretary: R. E. Cromwell.

The Canadian Car Company, Ltd., the largest manufacturers of railway equipment in the Dominion, entered the Canadian Aircraft Industry before the second world war by acquiring from the Grumman Aircraft Engineering Corpn., of Bethpage, L.I., N.Y., the licence to construct the Grumman two-seat fighter biplane.

It is licenced to build and supply to all countries, excluding the U.S.A., the North-American T-6 or Harvard. Under this agreement it delivered more than 500 Harvards to the R.C.A.F. and various N.A.T.O. powers and is still manufacturing Harvard spares for the R.C.A.F. and for export.

Can-Car has also signed an agreement with the Beech Aircraft Corporation for the rights to build the Beechcraft 73 Jet Mentor in Canada.

The aircraft division at Fort William is now largely engaged on sub-contract work for other firms in the Canadian aircraft industry. Airframe parts are being manufactured for the CS2F Tracker anti-submarine monoplane being built under a Grumman licence by de Havilland Aircraft of Canada, Ltd., while wings and tail surfaces for the de Havilland Otter are also being produced.

Canadian Car Company, Ltd. is a member of A. V. Roe, Canada, Ltd. and The Hawker Siddeley Group.

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT OF CANADA, LTD.

HEAD OFFICE AND WORKS: POSTAL STATION "L," TORONTO, ONTARIO.

Managing Director: P. C. Garratt.
Engineering Director: W. D. Hunter.
Sales Director: C. H. Dickins.
Production Manager: W. C. Burlison.
Secretary and Treasurer: G. J. Mickleborough.

The de Havilland Aircraft of Canada Ltd., was established early in 1928 by the de Havilland Aircraft Co., Ltd., as a Canadian constructional plant and service depot for D.H. aircraft.

The authorised capital of the Company is $500,000, of which $306,000 has been issued.

Considerable experimental work has been done in order to produce components and special accessories to meet all Canadian flying conditions.

Since the end of the war the company has flown three aircraft of original design —the DHC-1 Chipmunk two-seat trainer, and the DHC-2 Beaver and DHC-3 Otter, both single-engined cabin monoplanes designed for Canadian "bush" operations.

Initial production of a large number of Chipmunks was completed in 1951; but the type was put back into production in 1955 to meet new R.C.A.F. requirements. A full description of this aircraft has appeared in earlier editions of "All the World's Aircraft."

Well over 1,000 military and civil Beavers have been built, the majority of the military Beavers being for delivery to the U.S. Air Force and Army. The Beaver is now in wide use throughout Canada and in 53 foreign countries.

The Otter also has been in continuous production since March, 1953, and large numbers have been delivered to the Royal Canadian Air Force, Royal Norwegian Air Force, U.S. Navy, U.S. Army, Chilean Air Force and commercial operators.

On March 4, 1957, it was announced that an order for five twin-engined transports of an entirely new type, known as the DHC-4 Caribou, had been received from the Canadian Department of Defence Production on behalf of the U.S. Army, and delivery of these is scheduled to begin early in 1959.

The de Havilland Aircraft of Canada, Ltd. was awarded in March, 1954 a prime contract to build the Grumman S2F twin-engined anti-submarine monoplane under licence for the Royal Canadian Navy. Delivery of the first D.H.-built CS2F was made formally on October 12, 1956.

THE DHC-4 CARIBOU.

The decision to proceed with the design and development of this twin-engined transport aircraft was taken in 1956 after nearly two years of design study. Two prototypes are being developed in co-operation with the Canadian Army and Department of Defence Production, and the first is scheduled to fly by mid-summer, 1958. After completion of its Civil Airworthiness tests, it will be turned over to the Canadian Army for evaluation.

Five more Caribous have been ordered through the Department of Defence Production for evaluation by the U.S. Army, and delivery of these is scheduled to begin early in 1959. The U.S. Secretary of Defence has waived the restriction which limits U.S. Army fixed-wing aircraft to an empty weight of under 5,000 lb. (2,268 kg.) to make this purchase possible.

The Caribou is basically in the DC-3 load-carrying category but with short take-off and landing performance as good as, or even better than the Beaver and Otter. Its primary purpose as a military vehicle is to provide rapid mobility for troops, equipment and supplies in forward battle areas, and as a commercial transport for low-cost transportation of passengers and cargo in undeveloped areas.

The clear unobstructed cabin is fitted with large rear-loading doors which permit air-drop of heavy equipment. An adjustable loading ramp and freight-winching facilities provide for rapid loading and ensure a quick turn-round on the ground.

TYPE.—Twin-engined All-weather Utility transport.

WINGS.—High-wing cantilever monoplane. Aspect ratio 10. All-metal structure. Full span double-slotted flaps, outer trailing portions operated independently as ailerons. Gross wing area 912 sq. ft. (84.72 m.²).

FUSELAGE.—All-metal structure. Sharply upswept aft of wings, with upward and inward hingeing door forming underside of rear fuselage.

TAIL UNIT.—Cantilever monoplane tail with end-plate fins and rudders. All-metal structure. Marked dihedral on tailplane. Total area of fins and rudders 180 sq. ft. (16.72 m.²). Total area of tailplane and elevators 250 sq. ft. (23.23 m.²). Tailplane span 37 ft. (11.28 m.).

LANDING GEAR.—Retractable tricycle type.

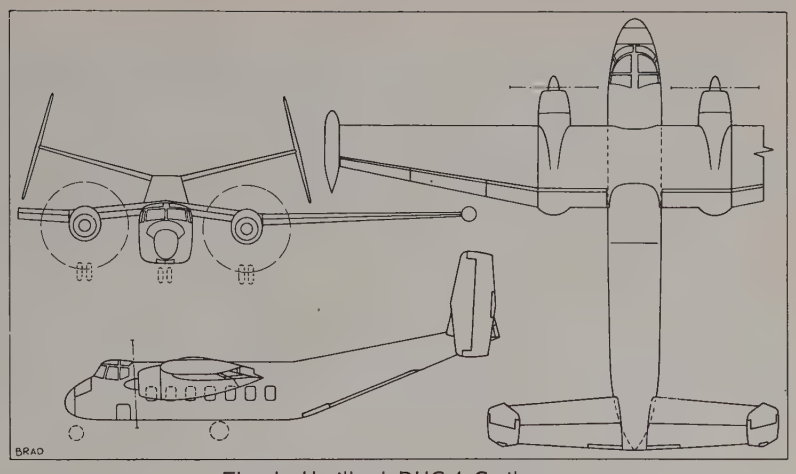
POWER PLANT.—Two Pratt & Whitney R-2000-D5 (civil) or R-2000-4 (military) fourteen-cylinder two-row radial air-cooled engines, with 1,450 h.p. available at 2,700 r.p.m. for take-off and maximum continuous rating of 1,200 h.p. at 2,500 r.p.m. Alternatively, two 1,425 h.p. Wright R-1820 nine-cylinder radial air-cooled engines may be fitted, and there is provision for later turboprop power plants. Fuel in tanks inside wings and on wing-tips.

ACCOMMODATION.—Pilot's compartment seats two side-by-side. Cabin will accommodate up to 32 passengers on normal commercial type seats or 28 fully-equipped troops on military bench-seats. Cargo payloads will vary from 6,000 lb. (2,722 kg.) to 7,320 lb. (3,320 kg.). Ambulance version will carry 22 standard litters or combinations of litters and seated persons. Cabin floor dimensions 23 ft. (7.01) m. long by 6 ft. 1½ in. (1.86 m.) wide. Maximum cabin width 6 ft. 11 in. (2.11 m.). Cabin height 7 ft. 3 in. (2.21 m.). Cabin volume 1,052 cub. ft. (29.79 m.³). Floor height from ground 42 in. (1.07 m.). Clear height under tail for loading 10 ft. (3.05 m.).

DIMENSIONS.—
Span (centre-lines of tip-tanks) 95 ft. (28.96 m.).
Length 63 ft. 8 in. (19.40 m.).
Height 27 ft. 8 in. (8.43 m.).

WEIGHTS.—
Weight empty 14,700 lb. (6,668 kg.).
Design gross weight 24,000 lb. (10,886 kg.).

PERFORMANCE (estimated).—
Cruising speed (750 h.p.) at 7,500 ft. (2,285 m.) 185 m.p.h. (297 km.h.).
Stalling speed 59 m.p.h. (95 km.h.).
Rate of climb at S/L. 1,580 ft./min. (482 m./min.).
Single-engine rate of climb at S/L. 420 ft./min. (128 m./min.).
Rate of climb at 5,000 ft. (1,525 m.) 1,580 ft./min. (482 m./min.).
Single-engine rate of climb at 5,000 ft. (1,525 m.) 380 ft./min. (116 m./min.).
Service ceiling 26,000 ft. (7,925 m.).
Single-engine ceiling 13,000 ft. (3,962 m.).
Take-off distance, 10 m.p.h. (16 km.h.) wind, 330 ft. (100 m.).
Take-off distance to 50 ft. (15.25 m.) zero wind 800 ft. (245 m.).
Landing distance from 50 ft. (15.25 m.) zero wind 700 ft. (213 m.).
Range with 6,000 lb. (2,722 kg.) payload 600 miles (965 km.).



The de Havilland DHC-4 Caribou.

Range with 6,700 lb. (3,039 kg.) payload 400 miles (645 km.).
Range with 7,320 lb. (3,320 kg.) payload 200 miles (322 km.).
Ultimate range 1,200 miles (1,930 km.).

THE DHC-3 OTTER.
U.S. Army designation: U-1.
U.S. Navy designation: UC-1.

The Otter, which flew for the first time on December 12, 1951, received its Certificate of Airworthiness both as a landplane and seaplane in October, 1952, and thereupon became the first single-engined aircraft to qualify for approval in accordance with ICAO Category D airworthiness requirements.

Otters delivered to the R.C.A.F. are engaged on Arctic Search and Rescue operation, paratroop dropping and aerial photographic duties. Commercially, Otters are operating over a wide range of climatic conditions, including territories such as Norway, Colombia and the Philippine Islands.

Early in 1955 D.H. Canada began production of 90 Otters for the U.S. Army. The first six were delivered on March 14, 1955, and assigned to topographical survey duties in Alaska, while the second six were flown to the Panama Canal Zone. Designated U-1A by the U.S. Army, Otters are also scheduled for use as supply aircraft in forward areas for transporting cargo, troops, paratroops, etc., and for casualty evacuation. One was equipped as a flight refuelling tanker aircraft to refuel a Vertol H-21C Work Horse helicopter on a 2,610 mile (4,200 km.) non-stop flight across the United States in August, 1956. The Otter is also being produced for the U.S. Navy as the UC-1 and aircraft of this type have accompanied the U.S. "Operation Deep-freeze" expedition to the Antarctic in 1956-58. Another is being used by the Commonwealth Trans-Antarctic Expedition.

TYPE.—Single-engined nine/eleven-passenger General Utility Transport.

WINGS.—High-wing braced monoplane. D.H. high-lift wing section. Aspect ratio 8.97. Dihedral 2°. All-metal structure. Single bracing strut on each side. Slotted inset ailerons. Double slotted flaps. Ailerons and flaps all-metal. Total aileron area 26.3 sq. ft. (2.44 m.²). Total area of flaps 98 sq. ft. (9.10 m.²). Gross wing area 375 sq. ft. (34.84 m.²).

FUSELAGE.—Of conventional all-metal structure.

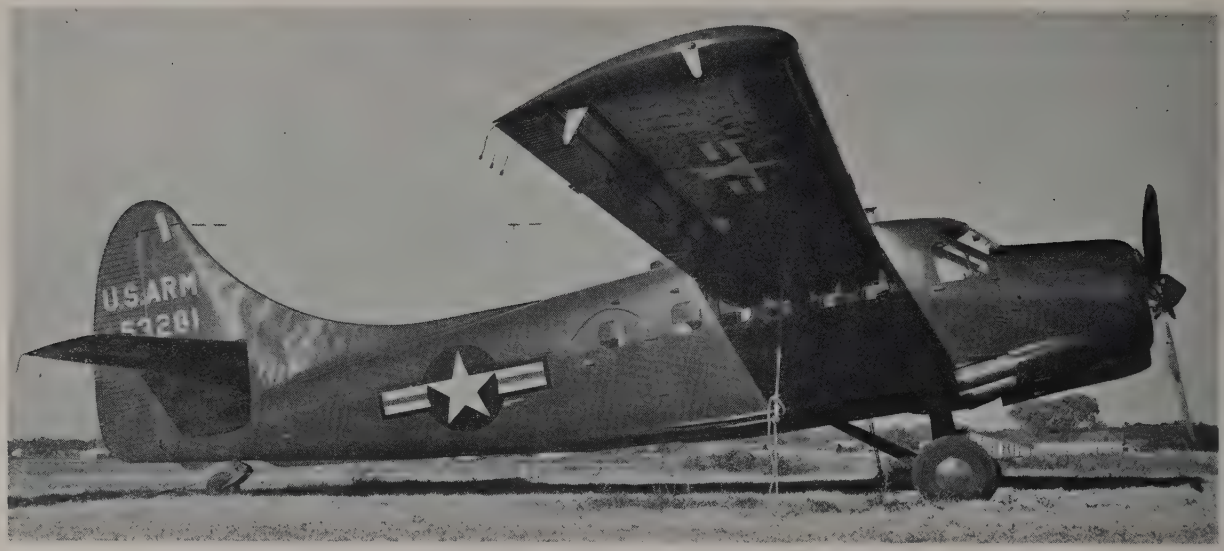
TAIL UNIT.—Cantilever monoplane type with tailplane halfway up fin which is integral with fuselage. All-metal structure. Total vertical area 60.2 sq. ft. (5.6 m.²). Total horizontal area 84.0 sq. ft. (7.8 m.²). Span of tail 21 ft. 2 in. (6.46 m.).

LANDING GEAR.—Interchangeable wheels, floats or skis. Wheel gear has D.H. rubber-in-compression springing. Goodyear wheels and brakes. Track 11 ft. 2 in. (3.42 m.). Wheelbase 27 ft. 10 in. (8.49 m.). Wheels interchangeable with D.H. skis or twin Edo 7170 all-metal single-step floats. Float base (C/L. of floats) 10 ft. 6 in. (3.20 m.). A combination wheel-ski landing-gear designed and manufactured by D.H. is available. The change from wheels to skis or *vice versa* is accomplished from the cockpit by hydraulic pump.

POWER PLANT.—One 600 h.p. Pratt & Whitney R-1340-S1H1-G or S3H1-G radial air-cooled engine driving a three-blade Hamilton Standard Hydromatic airscrew 10 ft. 10 in. (3.3 m.) diameter. Special exhaust system with four augmentor stacks. In these stacks exhaust gases produce suction strong enough to pull cooling air



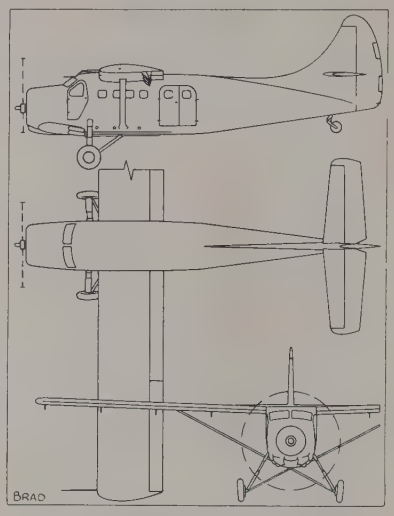
The de Havilland DHC-3 Otter Seaplane (600 h.p. Pratt & Whitney R-1340 engine).



The de Havilland DHC-3 Otter as supplied to the U.S. Army.

through engine and from behind engine accessories compartment while at same time providing measurable amount of thrust in cruising flight. Engine is effectively cooled during steep climbs when forward air speed is low and engine output near its maximum. Fuel tanks under cabin floor. Capacities: front 51 Imp. gallons (230 litres), middle (two cells) 85 Imp. gallons (386 litres), rear 42 Imp. gallons (190 litres). Total internal fuel capacity: 178 Imp. gallons (830 litres). Oil capacity 9 Imp. gallons (41 litres). Oil dilution system. Remote control fire-extinguisher system in engine compartment.

ACCOMMODATION.—Pilot's compartment seats two side-by-side, pilot (port) and co-pilot or passenger. Dual rudder pedals and W-type control column with throw-over wheel. Door on each side and one in bulkhead to cabin. Cabin is 16 ft. 5 in. (5.0 m.) long, 5 ft. 2 in. (1.58 m.) wide and 4 ft. 11 in. (1.5 m.) high, divided by bulkhead into 12 ft. 8 in. (3.8 m.) long main passenger or freight compartment and stowage compartment. Volume of main compartment 272 cub. ft. (7.6 m.^{3}), of stowage compartment 38 cub. ft. (1.06 m.^{3}). Doors on each side of main compartment 46.5 in. (118 cm.) wide on port, 30 in. (76.2 cm.) wide on starboard. Reinforced cargo floor. Cargo drop hatch, camera hole or paratroop exit in floor of stowage compartment.



The DHC-3 Otter.

Standard seating accommodation—9 folding seats for passengers in cabin, plus one in cockpit. Tenth seat in cabin available as optional extra. Alternatively, 6 stretchers and 4 passenger seats or 3 stretchers and 7 passenger seats. All seats quickly removable.

EQUIPMENT.—A 28-volt electrical system charged by a 50 or 100 amp. generator is provided. Navigation lights, controllable-intensity instrument lights, a 250-watt sealed-beam landing-light in the port wing leading-edge and cabin lights are provided. Racks in the stowage compartment give accessible installation to the battery and to radio and navigation equipment specified by the operator.

DIMENSIONS.—
Span 58 ft. (17.69 m.).
Length (landplane and seaplane) 41 ft. 10 in. (12.80 m.).
Height (landplane) 12 ft. 7 in. (3.83 m.).
Height (seaplane) 15 ft. 0 in. (4.57 m.).

WEIGHTS.—
Weight empty (landplane) 4,168 lb. (1,891 kg.).
Weight empty (seaplane) 4,620 lb. (2,096 kg.).
Weight empty (fixed skis) 4,361 lb. (1,978 kg.).
Weight empty (wheel/ski gear) 4,475 lb. (2,030 kg.).
Weight loaded (landplane) 8,000 lb. (3,630 kg.).
Weight loaded (seaplane) 7,967 lb. (3,613 kg.).



The de Havilland DHC-3 Otter Amphibian (600 h.p. Pratt & Whitney R-1340 engine).

PERFORMANCE (Landplane).—
Max. true level speed (600 h.p.) 160 m.p.h. (257 km.h.) at 5,000 ft. (1,525 m.).
True cruising speed (400 h.p.) 138 m.p.h. (222 km.h.) at 5,000 ft. (1,525 m.).
Rate of climb at S/L. (600 h.p.) 735 ft./min. (222 m./min.).
Service ceiling (S1H1-G engine) 18,800 ft. (5,730 m.).
Service ceiling (S3H1-G engine) 17,400 ft. (5,300 m.).
Max. range (full tanks) 960 miles (1,545 km.) at 5,000 ft. (1,525 m.).
Max. endurance 9.8 hours at 5,000 ft. (1,525 m.).
Take-off distance to 50 ft. (15.25 m.) (no wind) 1,310 ft. (400 m.).
Landing distance from 50 ft. (15.25 m.) 975 ft. (297 m.).

PERFORMANCE (Seaplane).—
Max. true level speed (600 h.p.) 153 m.p.h. (245 km.h.) at 5,000 ft. (1,525 m.).
True cruising speed (400 h.p.) 129 m.p.h. (207 km.h.) at 5,000 ft. (1,525 m.).
Rate of climb at S/L. 650 ft./min. (198 m./min.).
Service ceiling (S1H1-G engine) 17,900 ft. (5,450 m.).
Service ceiling (S3H1-G engine) 16,400 ft. (5,000 m.).
Max. range (full tanks) 863 miles (1,385 km.) at 5,000 ft. (1,525 m.).
Max. endurance 8.9 hours at 5,000 ft. (1,525 m.).
Take-off distance to 50 ft. (15.25 m.) 1,980 ft. (605 m.).
Landing distance from 50 ft. (15.25 m.) 1,210 ft. (369 m.).

PERFORMANCE (Skiplane).—
Max. true level speed (600 h.p.) 158 m.p.h. (254 km.h.) at 5,000 ft. (1,525 m.).
True cruising speed (400 h.p.) 133 m.p.h. (214 km.h.) at 5,000 ft. (1,525 m.).
Service ceiling (S3H1-G engine) 17,100 ft. (5,200 m.).
Service ceiling (S1H1-G engine) 18,600 ft. (5,670 m.).
Rate of climb (600 h.p.) 800 ft./min. (24.4 m./min.).

NOTE.—Range and endurance include allowances for 10 min. warm-up, take-off, climb to 5,000 ft. (1,525 m.) and fuel for 45 minutes at cruise power in reserve.

THE DHC-3 OTTER AMPHIBIAN.

An amphibian gear has been produced for the Otter by modifying standard Edo floats to accommodate retractable main and nose-wheels, combined with a slight lengthening of the floats to give sufficient increase in buoyancy to offset the wheel wells.

The main wheels are installed immediately aft of the step and retract into wells in the floats, while the nose-wheels lift forward and upward through 270° to lie in wells on the deck of the floats. All wheels and the standard landplane single disc brakes fitted to them are made of aluminium instead of magnesium to ensure maximum corrosion resistance.

Retraction is hydraulic, either by hand-pump or an electro-hydraulic power unit. In the "down" position, the wheels are fixed by hydraulic locking pins. The nose-wheels are fully-swivelling, with self-centering tyres to prevent shimmy. Handling on the ground is easier than with the standard landplane version because of the nose-wheel configuration.

Compared with the standard seaplane version, the Otter amphibian suffers little penalty in performance, the cruising speed being reduced by approximately 4 m.p.h. (6.4 km.h.). Take-off distance to 50 ft. (15.25 m.) on land is increased by only 130 ft. (40 m.) to 1,440 ft. (439 m.).

WEIGHTS.—
Weight empty 5,287 lb. (2,398 kg.).
Weight loaded 8,000 lb. (3,630 kg.).



The DHC-2 Beaver Skiplane (450 h.p. Pratt & Whitney R-985 engine).



The de Havilland DHC-2 Beaver as supplied to the U.S. Air Force.

THE DHC-2 BEAVER.

U.S. Army and U.S.A.F. designation: L-20.

More than 1,000 Beavers have been built for commercial operators and for the U.S. Army, with which the L-20 version is standard equipment. A single Beaver Mk. 2 was built with a 570 h.p. Alvis Leonides Series 502/4 engine and correspondingly improved performance. A description of this aircraft appeared in earlier editions of "All the World's Aircraft." The following data apply to the standard version with Wasp Junior engine.

TYPE.—Single-engined seven-seat landplane, seaplane or skiplane which may be used for military liaison and communications, military and civil cargo transportation, ambulance and rescue duties and civil agricultural and forestry operations.

WINGS.—High-wing braced monoplane. D.H. high-lift wing section. All-metal two-spar structure. Single bracing struts on each side. Entire trailing-edge hinged. Slotted ailerons and flaps interconnected so that when flaps are lowered to maximum angle of 58° the ailerons droop progressively to about 15° while retaining full lateral control. Hydraulic flap operation. Gross wing area 250 sq. ft. (23.2 m.²).

FUSELAGE.—Rectangular all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering.

LANDING GEAR.—Interchangeable floats, wheels and skis. Rubber-in-compression cantilever single-leg wheel gear with steerable tail-wheel. Goodyear wheels and brakes. Twin Edo Model 58-4580 all-metal floats. Float base (C/L of floats) 9 ft. 6¾ in. (2.92 m.). A combination wheel-ski gear designed and manufactured by D.H. is also available. The change-over from wheels to skis or *vice versa* is accomplished from the cockpit by hydraulic pump.

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 Wasp Junior nine-cylinder radial air-cooled engine driving a two-blade Hamilton Standard controllable-pitch airscrew 8 ft. 6 in. (2.59 m.) diameter. Fuel tanks (3) are under the cabin floor and easily removable for servicing. Tank fillers in fuselage sides to permit refuelling from ground or floats. Maximum internal fuel capacity 79 Imp. gallons (359 litres). Provision for wing-tip tanks of 36 Imp. gallons (165 litres) capacity. Oil tank and cooler in engine compartment aft of firewall. Oil-dilution system. Hand and electric starters. Remote-control fire-extinguishing system in engine compartment in civil version only.

ACCOMMODATION.—Pilot's compartment with pilot on port side and removable seat on starboard. Dual rudder pedals and Y-type control column with throw-over wheel. Entrance door with automobile-type sliding windows on each side. Cabin may seat seven passengers. Cabin heating. Floor stressed for freight-carrying. Lightweight collapsible bush-seats are interchangeable with cargo attachments. Two side doors, one on each side, wide enough to roll a 45-gallon petrol drum into cabin on its side. Hatches in rear wall of cabin to enable long pieces of freight, such as 10 ft. drilling-rods, to be loaded and stowed. Adequate baggage space at back of cabin, with separate locker aft for emergency rations, etc. Total cabin capacity 144 cub. ft. (4.07 m.³). Capacity available for freight payload 120 cub. ft. (3.35 m.³).

EQUIPMENT.—24-volt electrical system charged by engine-driven 1,500-watt generator. Batteries in rear fuselage on removable tray accessible through fuselage side. Provision for navigation lights, instrument lighting, anchor riding light and cabin lights. Fittings on floats chassis for 16 ft. canoe. Extra equipment to operators' specifications include radio, agricultural spraying or dusting equipment, etc.

DIMENSIONS.—
Span 48 ft. (14.64 m.).
Length (landplane) 30 ft. 3 in. (9.22 m.).
Length (seaplane) 32 ft. 9 in. (9.98 m.).
Height (landplane) 9 ft. 0 in. (2.75 m.).
Height (seaplane) 10 ft. 5 in. (3.18 m.).

WEIGHTS (Landplane).—
Weight empty 2,850 lb. (1,293 kg.).
Weight loaded 5,100 lb. (2,315 kg.).

WEIGHTS (Seaplane).—
Weight empty 3,168 lb. (1,437 kg.).
Weight loaded 5,100 lb. (2,315 kg.).

PERFORMANCE (Landplane).—
Max. true level speed (450 h.p.) 163 m.p.h. (262 km.h.) at 5,000 ft. (1,525 m.).
True cruising speed (300 h.p.) 143 m.p.h. (230 km.h.) at 5,000 ft. (1,525 m.).
Rate of climb at S/L. (450 h.p.) 1,020 ft./min. (311 m./min.).
Service ceiling 18,000 ft. (5,490 m.).
Cruising range (240 h.p.—internal fuel only) 455 miles (733 km.) at 5,000 ft. (1,525 m.).
Cruising range (240 h.p.—with wing-tip tanks) 733 miles (1,190 km.) at 5,000 ft. (1,525 m.).
Take-off distance to 50 ft. (15.25 m.) 1,015 ft. (310 m.).
Landing distance from 50 ft. (15.25 m.) 990 ft. (302 m.).

PERFORMANCE (Seaplane).—
Max. true level speed (450 h.p.) 151 m.p.h. (243 km.h.) at 5,000 ft. (1,525 m.).
True cruising speed (300 h.p.) 127 m.p.h. (204 km.h.) at 5,000 ft. (1,525 m.).
Rate of climb at S/L. (450 h.p.) 965 ft./min. (294 m./min.).
Service ceiling 15,750 ft. (4,810 m.).
Cruising range (internal fuel only) 405 miles (652 km.).
Cruising range (with wing-tip tanks) 655 miles (1,052 km.).
Take-off distance to 50 ft. (15.25 m.) 1,610 ft. (491 m.).
Landing distance from 50 ft. (15.25 m.) 1,510 ft. (460 m.).

NOTE.—Ranges include allowance for 10 minute warm-up, take-off, climb to 5,000 ft. and reserve fuel for 45 minutes flight at cruise power.

THE DHC-2 BEAVER AMPHIBIAN.

An amphibian gear has been designed for use with the Edo Model 58-4580 floats currently fitted to the Beaver. This gear makes use of the standard main wheels and brakes with which the landplane is normally fitted.

The main wheels are suspended below the floats aft of the step on levered rubber shock-absorbers and retract into wells in the floats. Functioning components of the shock-absorbing and retracting systems are completely enclosed within the float shell and are not exposed to water.

A nose-wheel unit is mounted on the front bulkhead of each float and when not in use is rotated up and over to lie on the float deck. A levered rubber shock-absorbing system is also used in the nose-wheel installation. The nose-wheels are free-swivelling and are fitted with anti-shimmy twin-contact tyres. A centering lock is also provided for each nose-wheel to prevent misalignment when in the retracted position.

Retraction is by hydraulic jacks at each wheel unit, operated from a hand-pump and selector control in the cockpit. Both main and nose-wheel systems are fitted with mechanical down-locks, which are automatically released for the retraction cycle. A position indicator is fitted on the cockpit control unit.



The DHC-2 Beaver Amphibian (450 h.p. Pratt & Whitney R-985 engine).

Compared with the standard seaplane, the Beaver amphibian suffers no measurable penalty in performance. Fully loaded and in zero wind, the amphibian is airborne in 885 ft. (270 m.) on water. As a landplane the amphibian taxis and handles easily and take-off and landing distances are affected only slightly. Fully-loaded and in zero wind the take-off is accomplished in 595 ft. (181 m.).

WEIGHTS.—
Weight empty 3,641 lb. (1,652 kg.).
Weight loaded (on land) 5,100 lb. (2,313 kg.).
Weight loaded (on water) 5,000 lb. (2,268 kg.).

FAIREY

THE FAIREY AVIATION COMPANY OF CANADA LTD.

HEAD OFFICE AND PRINCIPAL PLANT: EASTERN PASSAGE, HALIFAX COUNTY, N.S.

BRANCH PLANT: PATRICIA BAY AIRPORT, SIDNEY, B.C.

President: S. G. Dixon, O.B.E., Q.C.

Managing Director: C. E. Hibbert, M.B.E.

Chief Designer: E. C. Garrard, A.M.I. Mech.E., A.F.R.Ae.S., A.F.C.A.I.

Secretary-Treasurer: A. M. Cameron.

The Fairey Aviation Co. of Canada Ltd. was incorporated in November, 1948, initially to undertake the maintenance, overhaul and repair of aircraft for the Royal Canadian Navy. Early in 1955, the Branch Plant was established at Patricia Bay on Vancouver Island.

Both plants are currently engaged in the maintenance, repair, overhaul and conversion of aircraft for the Royal Canadian Navy and the Royal Canadian Air Force. The principal types handled at Eastern Passage are the F2H-3 Banshee jet-fighter which is replacing the Sea Fury in R.C.N. service, the Canadian-built CS2F Tracker anti-submarine aircraft and the Avenger. For the R.C.A.F., the P2V-7 Neptune and Lancaster are being repaired and modified, and the Canadair Argus is expected to appear for maintenance, repair and overhaul within a year.

Manufacture of Hydro-booster powered control units for the CF.100 is still under way and these units are being overhauled and repaired for the R.C.A.F. In addition, the bomb-bay door actuator and nose-wheel actuator for the Argus were both designed and manufactured at the Eastern Passage plant.

At Patricia Bay, maintenance, repair, overhaul and modification programmes have been carried out on Harvard, Avenger, Lancaster and Canso aircraft. In addition, many types of light and heavy commercial aircraft passed through this plant during 1956-57.

The labour force at the Eastern Passage plant has risen to slightly over 1,000 employees; while at Patricia Bay a new hangar has been added, with a corresponding growth in all departments.

FLEET

FLEET MANUFACTURING, LIMITED.

HEAD OFFICE AND WORKS: FORT ERIE, ONTARIO.

President and General Manager: Herman L. Eberts.

Secretary and Treasurer: N. Ellwood Butler.

Fleet Aircraft, Ltd. was incorporated under a Dominion charter in 1930 to manufacture the Fleet Trainer, the exclusive World rights for the construction of which were obtained from the Consolidated Aircraft Corporation.

The Fleet Trainer, known in Canada as the Finch, was adopted by the R.C.A.F. for primary training and was later used in the British Commonwealth Air Training Plan. By 1941 over 600 Finches had been built.

The Finch was followed by the Fairchild PT-26, or Cornell, and Fleet built some 3,000 Cornells between 1942 and 1944.

After the war Fleet was unable to weather the post-war recession and it dropped out of the aircraft industry to devote its attention to the manufacture of consumer goods and other non-aeronautical products. The name of the company was then changed to Fleet Manufacturing, Limited.

In 1953 the company re-entered the aircraft industry by undertaking the manufacture under sub-contract of major airframe components for Canadair, Ltd., A. V. Roe Canada, Ltd., de Havilland Aircraft of Canada, Ltd., and the Republic Aviation Corporation, as well as parts and assemblies for other contractors to the aircraft industry.

In 1954 a subsidiary, jointly owned by Fleet & Doman Helicopters, Inc. of Danbury, Connecticut, U.S.A., and known as Doman-Fleet Helicopters, Ltd. was formed to build and market the Doman LZ-5 eight-seat helicopter in Canada. The first Fleet-built LZ-5 was flown for the first time on June 4, 1955. For details of the LZ-5 see under "Doman" (U.S.A.).

Fleet is also licenced by the Helio Aircraft Company of Norwood, Mass., U.S.A., to build the Helio Courier four-seat cabin monoplane and to sell it in Canada and the British Commonwealth. The first Courier to be manufactured and assembled in Canada made its first flight on February 1, 1955. This aircraft, after receiving its Canadian C. of A. has been used as a company demonstrator. For details of the Courier see under "Helio" (U.S.A.).

KAMAN

KAMAN AIRCRAFT OF CANADA, LTD.

HEAD OFFICE: St. Catherines, Ontario.

President: Charles H. Kaman.

Vice-President, Engineering: John Emerson.

Managing Director: Gerald R. Wooll.

Secretary: Philip H. Sullivan.

Treasurer: Bruce F. Clark.

Kaman Aircraft of Canada, Ltd. has been formed as a fully-owned subsidiary by the Kaman Aircraft Corporation, of Bloomfield, Conn., U.S.A., so as to be in a position to enter the Canadian helicopter market when the time is propitious. Full details of Kaman helicopters will be found under "Kaman" (U.S.A.).

VERTOL

VERTOL AIRCRAFT COMPANY (CANADA) LTD.

HEAD OFFICE AND WORKS: ARNPRIOR, ONTARIO.

General Manager: Max Bowen.

This company is a wholly-owned subsidiary of the Vertol Aircraft Corporation of Morton, Pennsylvania, but is administered as an independent company. It was formed in February, 1954 with a nucleus of 10 employees, which had grown to a total of 55 persons by the beginning of 1957. Its plant, with a floor area of 42,500 sq. ft. (3,950 m.²), is on the former R.C.A.F. airfield at Arnprior, fifty miles west of Ottawa.

Major work undertaken by the company is the servicing and overhaul of Vertol H-21 Work Horse helicopters flown by the R.C.A.F., and Vertol HUP helicopters of the Royal Canadian Navy. In addition to overhaul of complete aircraft and components at Arnprior, mobile repair parties are sent to helicopter units operating in remote areas of Canada.

On November 28, 1956, an R.C.A.F. H-21A began at Arnprior the flight testing necessary for commercial certification of the Work Horse under a programme conducted jointly by the parent company and Vertol Aircraft Company (Canada) Ltd., to meet the requirements of the U.S. Civil Aeronautics Administration and the Canadian Department of Transport.

INDIA

HINDUSTAN

HINDUSTAN AIRCRAFT (PRIVATE) LTD.

HEAD OFFICE AND WORKS: BANGALORE (MYSORE STATE).

Chairman of the Board of Directors: M. K. Vellodi, Secretary, Ministry of Defence, Government of India.

Managing Director and General Manager: J. M. Shrinagesh, C.I.E., I.C.S.

Deputy General Manager (Engines): P. M. Reddy.

Chief Designer: Dr. V. M. Ghatage, M.Sc., D.Phil., A.F.R.Ae.S., M.I.Ae.S., F.A.Sc., A.M.I.E., F.Ae.S.I.

Financial Manager: V. G. Kamath.

Production Adviser: J. J. M. Dziewonski, A.M.I.Mech.E., A.F.R.Ae.S., M.S.A.E.

Factory Manager: Albert Zampolino.

Hindustan Aircraft (Private) Ltd. is India's only aircraft manufacturing establishment. It serves not only India's domestic needs, but also those of many of the airline operators and air forces in Asian countries and the Middle East.

On the manufacturing side, the HT-2 trainer is now in production and is being delivered to the Indian Air Force and Navy. An initial order for five HT-2's has also been placed by the Director-General of Civil Aviation. The HT-2 is now available for export and it has been demonstrated in several Far Eastern countries.

Under the Colombo Plan, the Government of Singapore was given one HT-2 early in 1957, together with the services of a pilot instructor and service engineer, to train local pilots.

Hindustan-built Vampires are also being supplied to the Indian Air Force according to programme. A licence to manufacture the Folland Gnat single-seat light fighter for the Indian Air Force was acquired in September, 1956; and Hindustan Aircraft is also manufacturing the Bristol Orpheus turbojet engines for these Gnats, under a licence agreement with Bristol Aero-Engines, Ltd.

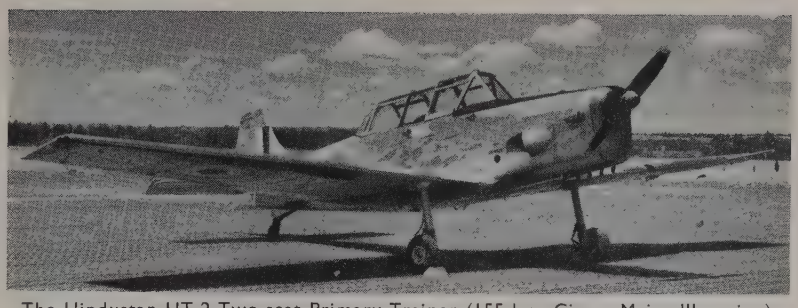
Hindustan Aircraft is recognised by the Directorate of Civil Aviation in India and has the approval of the American C.A.A. for the repair and overhaul of DC-3's, C-47's and Pratt & Whitney aero-engines. In addition to approval for DC-3 work, the company is an authorised DC-3 service centre of the Douglas Aircraft Company. Hindustan is also repair and service agent in India for the de Havilland companies.

The company's branch factory in Calcutta is continuing to concentrate on the repair and overhaul of DC-3's belonging to the Indian Airline Corporation and non-scheduled operators. In addition, this branch factory will be equipped for the servicing, repair and overhaul of helicopters.

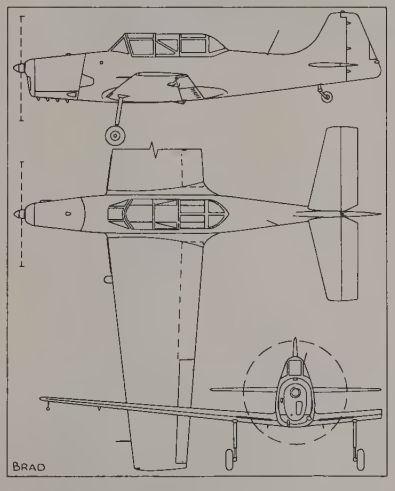
In addition to aircraft work, the factory is manufacturing railway coaches for the Indian Railways and omnibus body kits for the municipal authorities of most of the important cities in India.

The company's works in Bangalore are spread over an area of 1,100 acres, and the total personnel employed is over 11,000.

Under India's Second Five-year Plan Hindustan Aircraft will be undertaking the design and manufacture of a jet trainer, advanced jet fighters and aero-engines.



The Hindustan HT-2 Two-seat Primary Trainer (155 h.p. Cirrus Major III engine).



The Hindustan HT-2.



Two Hindustan HT-2 Trainers of the Indian Air Force.

THE HINDUSTAN HT-2.

TYPE.—Two-seat Primary Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23012. Aspect ratio 7.13. Dihedral 5.15 degrees. All-metal two-spar structure. All-metal split flaps. Area of ailerons (2) 14.35 sq. ft. (1.33 m.²) Total flap area 14.18 sq. ft. (1.31 m.²). Gross wing area 173.4 sq. ft. (16.0 m.²).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: fin 9.34 sq. ft. (0.86 m.²), rudder 8.17 sq. ft. (0.75 m.²), tailplane 16.8 sq. ft. (1.58 m.²), elevators (2) 11.2 sq. ft. (1.05 m.²).

LANDING GEAR.—Fixed tail-wheel type. Hindustan oleo-pneumatic shock-absorber struts. Dunlop wheels and hydraulic single-disc type brakes. Track: 9 ft. (2.74 m.).

POWER PLANT.—One 155 h.p. Cirrus Major III four-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch wood airscrew. Two fuel tanks in wings. Total fuel capacity 26 Imp. gallons (117 litres).

ACCOMMODATION.—Enclosed tandem cockpits with dual controls. Separate sliding sections over each cockpit. Full standard basic training equipment, night and blind flying training equipment, etc.

DIMENSIONS.—
Span 35 ft. 2 in. (10.72 m.).
Length 24 ft. 8.6 in. (7.53 m.).
Height 8 ft. 11 in. (2.74 m.).

WEIGHTS.—
Weight empty 1,540 lb. (702 kg.).
Weight loaded 2,240 lb. (1,018 kg.).

PERFORMANCE.—
Max. speed 130 m.p.h. (209 km.h.).
Cruising speed 115 m.p.h. (185 km.h.).
Stalling speed without flaps 52 m.p.h. (84 km.h.).
Initial rate of climb 800 ft./min. (244 m./min.).
Service ceiling 14,500 ft. (4,420 m.).
Absolute ceiling 16,500 ft. (5,060 m.).
Still air range 350 miles (560 km.).
Endurance at cruising speed 3.5 hours.

BULGARIA

LAZAROW

ENG. CWIETAN LAZAROW.

The first post-war aircraft of Bulgarian origin, the LAZ-7, was the work of Eng. Cwietan Lazarow, the Bulgarian designer who was responsible for the pre-war DAR aircraft and for the only nationally-designed wartime military aircraft, the DAR-10 light bomber of 1941. A brief description of the LAZ-7 is given below.

The basic LAZ-7 design has been developed progressively into a four-seat air-taxi and liaison aircraft, designated LAZ-8. An ambulance version of the LAZ-8, known as the LAZ-11, was also built, but only in prototype form.

Lazarow's latest fixed-wing design is a single-seat advanced trainer ; but nothing is known of this except that its cockpit is situated far back in the fuselage near the fin and that it has a wing span of 8 m. (26 ft. 3 in.).

Since 1953, Lazarow has also been engaged actively in helicopter studies and a brief description of his latest helicopter project, the LAZ-10H, appears below.

THE LAZAROW LAZ-7.

The LAZ-7 tandem two-seat sports and training monoplane was designed in 40 days to a specification issued by Yugoslavia in 1946. The prototype, powered by a 160 h.p. Walter Minor 6-III engine, won the eliminating trials in competition with its Yugoslav rival, the Aero 2S with a similar power plant.

WEIGHT.—
Weight loaded 927 kg. (2,044 lb.).

PERFORMANCE.—
Max. speed 240 km.h. (149 m.p.h.).
Cruising speed 215 km.h. (133.5 m.p.h.).
Landing speed 85-100 km.h. (53-62 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 4 min. 47 sec.
Climb to 4,000 m. (13,120 ft.) 28 min. 39 sec.
Ceiling 5,250 m. (17,225 ft.).
Range 845 km. (525 miles).
Endurance 3 hr. 56 min.

THE LAZAROW LAZ-7M.

Following its success in the Yugoslav competition, the LAZ-7 was extensively redesigned. The new version, known as the LAZ-7M, is powered by a Russian 160 h.p. M-11FR five-cylinder air-cooled radial engine enclosed in a helmeted cowling and driving a Visch V-501 two-blade variable-pitch airscrew.

It is an orthodox low-wing monoplane with fixed tail-wheel landing gear. The fuselage is of welded steel-tube construction, with wooden formers and fabric covering. Wings and tail surfaces are also of mixed wood and metal construction with fabric covering.

The LAZ-7M was put into production at the Bulgarian State Aircraft Works and is in service with the national flying clubs.

THE LAZAROW LAZ-8.

The LAZ-8 is a four-seat air taxi and liaison version of the Lazarow LAZ-7M described earlier. No further details are available.

THE LAZAROW LAZ-10H.

The LAZ-10H is a lightweight single-rotor helicopter, seating two side-by-side in an enclosed cabin. It is powered by two pulse-jet engines, mounted on the tips of the two-blade rotor. The rotor blades can be folded and the tail-boom removed for transport. Re-assembly of the helicopter takes ten minutes.

WEIGHTS (estimated).—
Weight empty 155 kg. (342 lb.).
Weight loaded 420 kg. (926 lb.).

PERFORMANCE (estimated).—
Max. speed 120 km.h. (74.5 m.p.h.).
Cruising speed 100 km.h. (62 m.p.h.).
Service ceiling 4,000 m. (13,125 ft.).
Hovering ceiling 1,200 m. (3,940 ft.).
Endurance 1 hr.

CHILE

FANAERO-CHILE

FÁBRICA NACIONAL DE AERONAVES (FANAERO-CHILE).

HEAD OFFICE : HUÉRFANOS 1202, PISO 4, SANTIAGO DE CHILE.

Directors : General de Brigada Aérea (R) don Edison Díaz Salvo (Chairman) ; Comandante de Grupo Ingeniero don Hugo Fuentes Fuentes (Manager of Fanaero-Chile) ; don Juan Fontecilla Astaburuaga (Fiscal representative) ; Coronel don Eduardo Iensen Franke (Under-Secretary for Aviation) ; Coronel don Julio Tapia Jiménez (Director of Services, Chilean Air Force) ; Coronel don Renato González Allendes (Director of Air Transport) ; don Emilio González González (Chairman of the National Council for Foreign Trade) ; don Renato Mujica Gómez (Manager of the State Bank) ; and don Humberto Diaz Contreras (Engineer and representative of the Corporación de Fomento de la Producción).

The Fabrica Nacional de Aeronaves (Fanaero-Chile) was created under the laws of the Republic in June, 1953, as a national but self-administered enterprise to be responsible for the manufacture of certain types of aircraft, gliders, aircraft parts and other aeronautical equipment.

Fanaero-Chile has its headquarters in Sántiago and will have its production facilities at Rancagua, Province of O'Higgins, some 43 miles from Santiago. Pending the construction of the necessary plant and hangars, which is being undertaken by the Corporacion de Fomento de la Produccion, Fanaero-Chile is temporarily using the facilities of the Maestranza Central de Aviacion.

The first aircraft designed and built by Fanaero-Chile is the Chincol primary trainer, of which a full description follows. The company is building the prototype of a jet-powered elementary trainer of which no details were available at the time of writing.



The Fanaero-Chile Chincol (215 h.p. Continental O-470-11 engine).

THE FANAERO-CHILE CHINCOL.

Designed by Ing. Alfredo Davins Ferrer, the prototype of the Chincol was first flown on December 14, 1955, and has completed successfully its test flight programme. A series of 50 Chincol trainers is being built for the Chilean Air Force. They have a safety factor of 9 for advanced aerobatic flying.

TYPE.—Two-seat Primary Military Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section NACA 23015 (root), NACA 23009 (tip). Aspect ratio 6.8. Chord 1.9 m. (6 ft. 3 in.) at root, 1.15 m. (3 ft. 9 in.) at tip. Dihedral 6°. Incidence 2°. All-wood two-spar structure, plywood covered and with an outer fabric covering overall. Material used throughout is a Chilean wood known as Mañío. Removable wing-tips. All-wood slotted ailerons. Prototype has no flaps, but flaps will be fitted to production aircraft. Total aileron area 1.56 m.² (16.8 sq. ft.). Gross wing area 15.7 m.² (169 sq. ft.).

FUSELAGE.—Welded steel-tube structure, with frames of Mañío wood. Plywood-covered rear fuselage.

TAIL UNIT.—All-wood cantilever monoplane structure. Total area of vertical surfaces 1.15 m.² (12.37 sq. ft.). Total area of horizontal surfaces 2.77 m.² (29.81 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever main units have rubber-in-compression shock-absorbers. Hydraulic brakes. Wheel track 2.30 m. (7 ft. 7 in.).

POWER PLANT.—One 215 h.p. Continental O-470-11 six-cylinder horizontally-opposed air-cooled engine.

DIMENSIONS.—
Span 10.40 m. (34 ft. 1 in.).
Length 7.22 m. (23 ft. 8 in.).
Height 2.10 m. (6 ft. 10 in.).

WEIGHTS.—
Weight empty 740 kg. (1,632 lb.).
Weight loaded 1,050 kg. (2,315 lb.).

PERFORMANCE.
Max. speed at S/L. 210 km.h. (131 m.p.h.).
Cruising speed 185 km.h. (115 m.p.h.).
Stalling speed 90 km.h. (56 m.p.h.).
Rate of climb at S/L. 245 m./min. (805 ft./min.).
Service ceiling 5,400 m. (17,700 ft.).
Absolute ceiling 6,200 m. (20,340 ft.).
Take-off distance to 15 m. (50 ft.) 240 m. (787 ft.).
Landing distance from 15 m. (50 ft.) 340 m. (1,115 ft.).
Cruising radius 650 km. (404 miles).

CZECHOSLOVAKIA

CESKOSLOVENSKÉ ZÁVODY AUTOMOBILOVÉ A LETECKÉ (Czechoslovak Automobile and Aircraft Works).

HEAD OFFICE: PALACKÉHO NAM. 4, PRAGUE II.

Manager: Ladislav Hlavsa.

In this concern is grouped all the Czech aviation industry, including all factories engaged in the production of aircraft, aero-engines and airscrews.

In addition to the Czech-designed aircraft described and illustrated below, these factories are building several types of Soviet-designed aircraft, including the Ilyushin Il-28 light jet-bomber and the MiG series of jet-fighters.

Production of the MiG-15 has been completed and has been followed by limited production of the MiG-17. In mid-1957, Czech factories were tooling up to build the supersonic MiG-19.

The sale of all the aviation products as well as the information service are handled exclusively by:

OMNIPOL LIMITED, WASHINGTONOVA 11, PRAGUE III.

THE CS-102.

The initial version of the Soviet MiG-15 jet-fighter, as built in Czechoslovakia, was designated CS-102. It was powered by an RD-45F turbojet supplied from Soviet production.

THE S-103.

Under the designation of S-103, Czech factories have manufactured large numbers of MiG-15 fighters, powered by Czech-built Klimov VK-1 turbojets and incorporating design improvements compared with the CS-102. All components were built in Czechoslovakia.

Aircraft of this type were supplied to the Egyptian Air Force.

THE C-11.

C-11 is the designation of the Russian Yak-11 two-seat intermediate and advanced training aircraft built under licence in Czechoslovakia. Full details of this aircraft are given in the U.S.S.R. section of this work.

THE C-11U.

The C-11U is a Czech licence-built version of the Yak-11U, of which full details appear in the U.S.S.R. section. It is basically similar to the C-11, but has a nose-wheel landing-gear.

THE TOM-8 (L-208).

TYPE.—Two-seat Training monoplane.

WINGS.—Cantilever low-wing monoplane. NACA 63 series wing section. Aspect ratio 6.94. Chord at root 2.2 m. (7 ft. 2½ in.), at tips 1.0 m. (3 ft. 3 in.). Dihedral on centre-section —25′, on outer wing 6.5°. Incidence 2° 30′. All-metal structure. Centre-section integral with fuselage. Two-spar outer wings attached to centre-section through three hinges. Statically and aerodynamically balanced Frise-type ailerons of metal construction with fabric covering. Ground-adjustable trim/balance tab on each aileron. Split flaps in four sections, operated electro-hydraulically. Total area of ailerons 1.318 m.² (14.18 sq. ft.). Total area of flaps 3.838 m.² (41.31 sq. ft.). Wing area 17.255 m.² (185.7 sq. ft.).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Elevators and rudder fabric-covered. Controllable trim-tab in port elevator; ground-adjustable balance tab in starboard elevator. Controllable trim-tab in rudder. Areas: fin 0.84 m.² (9.04 sq. ft.), rudder 1.10 m.² (11.84 sq. ft.), tailplane 2.114 m.² (22.75 sq. ft.), elevators 1.134 m.² (12.2 sq. ft.). Tailplane span 3.86 m. (12 ft. 8 in.).

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Oleo - pneumatic shock-absorbers. Hydraulic brakes. Nose-wheel 420×150 mm. Wheel track 2.64 m. (8 ft. 8 in.). Wheelbase 2.46 m. (8 ft. 1 in.).

POWER PLANT.—One 235 h.p. M-208C six-cylinder horizontally-opposed air-cooled engine, driving two-blade metal variable-pitch airscrew, diameter 2.4 m. (7 ft. 10 in.) with electro-automatic or manual control. Fuel in two tanks in centre-section with total capacity of 180 litres (39.6 Imp. gallons). Small auxiliary tank permits inverted flight for one minute.

ACCOMMODATION.—Crew of two in tandem cockpits, with instructor to rear. Separate canopies hinge upwards to starboard and are jettisonable. Complete dual controls and instruments.

DIMENSIONS.—Span 10.93 m. (35 ft. 10 in.).
Length 9.37 m. (30 ft. 9 in.).
Height 3.17 m. (10 ft. 5 in.).

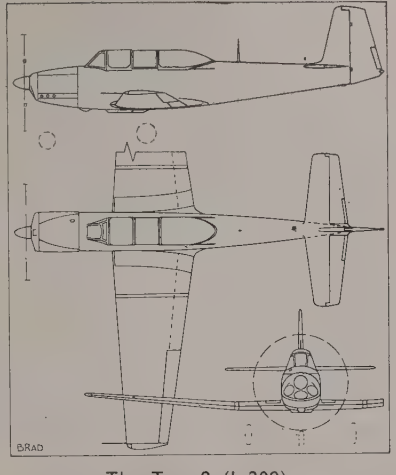
WEIGHTS AND LOADINGS.—
Weight empty 1,060 kg. (2,337 lb.).
Weight loaded (normal) 1,380 kg. (3,042 lb.).
Weight loaded (aerobatic) 1,300 kg. (2,866 lb.).
Wing loading (normal) 80 kg./m.² (16.39 lb./sq. ft.).
Power loading (normal) 5.89 kg./h.p. (12.98 lb./h.p.).



The C-11 Two-seat Trainer, the Czech-built version of the Russian Yak-11.



The C-11U, which is similar to the C-11 except for the landing-gear.



The Tom-8 (L-208).



The Tom-8 Two-seat Trainer (235 h.p. M-208C engine).

PERFORMANCE.—
Max. speed 285 km.h. (177 m.p.h.).
Cruising speed at 1,000 m. (3,280 ft.) 240 km.h. (149 m.p.h.).
Landing speed 100 km.h. (62 m.p.h.).
Rate of climb at S/L. 325 m./min. (1,065 ft./min.).
Service ceiling 6,050 m. (19,850 ft.).
Range 720 km. (447 miles).
Endurance 3 hours.

THE L-60 BRIGADYR.

The L-60 is a light three-seat or four-seat all-metal monoplane suitable for a wide variety of duties. About 50 had been built by mid-1957.

The military version can be used for liaison, air ambulance work, decontamination, parachute jumping, aerial photography, bombing and other duties.

The civil version is being produced as a light four-seat transport or sporting aircraft, which can be used also as a primary trainer or for glider-towing. It is easily adapted to carry two stretcher cases and a medical attendant, in addition to the pilot.

For agricultural duties, the L-60 can be equipped for normal farm and forest pest control operations with spray or gas, for decontamination of contaminated areas, top-dressing, seed-sowing, forest fire patrol and fire-fighting, and other tasks.

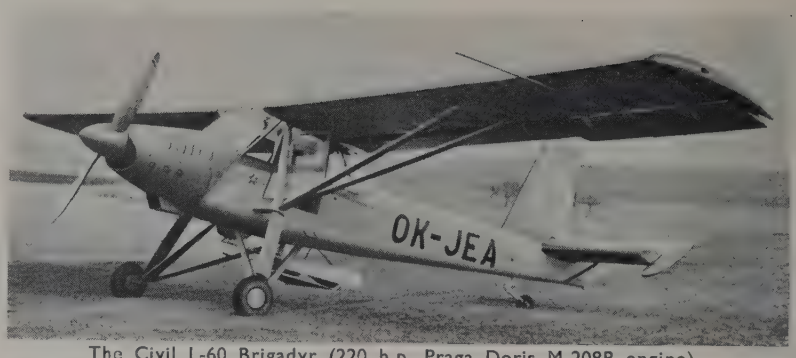
TYPE.—Light General Purpose monoplane.

WINGS.—High-wing strut-braced monoplane. NACA 4412 wing section. Aspect ratio 8.07. Dihedral 1° 30′. Incidence 3°. Constant chord all-metal two-spar structure with fabric covering between the spars. Frise-type ailerons with metal structure and fabric covering, part-balanced statically and aerodynamically. Double-slotted flaps with metal structure and fabric covering are interconnected with the ailerons and leading-edge slots, except on agricultural version which has fixed slots. Flaps and slots are electrically actuated. Up and down movement of ailerons with flaps locked is 30° and 20° respectively. From the 15° down take-off position of the wing flaps, the ailerons are moved so that they are 15° down when the flaps are 50° down. Total area of ailerons 2.46 m.² (26.5 sq. ft.). Total area of flaps 4.042 m.² (43.5 sq. ft.). Wing area 24.30 m.² (261.6 sq. ft.).

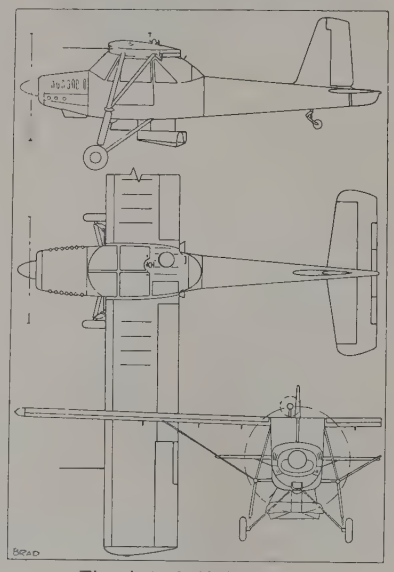
FUSELAGE.—All-metal monocoque construction.

TAIL UNIT.—All-metal cantilever monoplane structure, with the fin forming an integral part of the fuselage. Metal-covered variable-incidence tailplane (range 3° up, 5° down). Fabric-covered elevators and rudder are statically and dynamically balanced. Elevators fitted with two outer balance tabs and two inner trim-tabs which are operated by the pilot and linked automatically with the tailplane. Areas: fin 0.761 m.² (8.19 sq. ft.), rudder 0.96 m.² (10.33 sq. ft.), tailplane 1.964 m.² (21.14 sq. ft.), elevators 2.796 m.² (30.09 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock absorber struts on main and tail wheels. Low pressure tyres diameter 500 × 180 mm. on main wheels and 260 × 85 mm. on tail-wheel. Hydraulic brakes. Wheel track 3.0 m. (9 ft. 10 in.). Wheelbase 5.60 m. (18 ft. 4 in.).



The Civil L-60 Brigadyr (220 h.p. Praga Doris M-208B engine).


The Avia L-60 Brigadyr.

POWER PLANT.—One Praga Doris M-208B "flat" six-cylinder air-cooled engine rated at 220 h.p. for take-off at 3,000 r.p.m., with a nominal power of 200 h.p. at 2,900 r.p.m. and a cruising power of 190 h.p. at 2,800 r.p.m. Two-bladed wooden controllable-pitch Type V411 airscrew with a pitch range of 18 degrees is manually-controlled. Diameter of airscrew 2.7 m. (8 ft. 10 in.). Fuel in four wing tanks with total capacity of 200 litres (44 Imp. gallons).

ACCOMMODATION (Military version).—Crew of three, pilot, wireless-operator and rear-gunner, on two side-by-side front seats and a single rear seat. Dual controls can be fitted.

ACCOMMODATION (Civil version).—Four seats in two pairs. The rear portion of the canopy hinges down for easy loading and unloading of two stretchers in air ambulance version, which has also a seat for a medical attendent in the rear of the cabin.

EQUIPMENT (Military version).—Type RSI-6 and RPKO-10 radio sets. One machine-gun. Blind-flying equipment for night operations.

EQUIPMENT (Agricultural version).—Can have either 420-litre (92 Imp. gallon) tank for chemicals and spray-bars, or hopper for 300 kg. (660 lb.) of dust. Dusting and spraying equipment is driven mechanically from the engine under control of pilot. Dispersion rate for oil spraying 5-12 litres (1-2.64 Imp. gallons) per hour; for water spraying 50-300 litres (11-66 Imp. gallons) per hour; for dust 5-300 kg. (11-660 lb.) per hour.

DIMENSIONS.—
Span 13.96 m. (45 ft. 9½ in.).
Length 8.54 m. (28 ft.).
Height 2.72 m. (8 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 955 kg. (2,105 lb.).
Normal weight loaded 1,415 kg. (3,120 lb.).
Max. permissible loaded weight 1,560 kg. (3,439 lb.).
Wing loading 58.4 kg./m.² (11.96 lb./sq. ft.).
Power loading 6.4 kg./h.p. (14.1 lb./h.p.).

PERFORMANCE.—
Max. speed 190 km.h. (118 m.p.h.).
Cruising speed at S/L. 175 km.h. (109 m.p.h.).
Stalling speed 52 km.h. (32 m.p.h.).
Service ceiling 4,500 m. (14,765 ft.).
Climb to 1,000 m. (3,280 ft.) 4.3 min.
Climb to 3,000 m. (9,850 ft.) 17.5 min.
Take-off run from grass to clear 15 m. (50 ft.) 225 m. (740 ft.).
Landing run on grass from 15 m. (50 ft.) 195 m. (640 ft.).
Range at 1,000 m. (3,280 ft.) 720 km. (447 miles).
Fuel consumption at cruising speed 48 litres/hr. (10.56 gal./hr.).

THE LD-40 META-SOKOL.

The prototype LD-40 Meta-Sokol with M332 supercharged engine completed its flight tests in March, 1956. It has a "reversed tricycle" landing-gear, in which the retractable tailwheel is mounted under the rear of the cabin and keeps the fuselage almost horizontal on the ground.

A 105 h.p. Walter Minor 4-III engine can be fitted as an alternative to the M332, the two engines being dimensionally interchangeable.

The following details apply to the standard M332-powered version:—

TYPE.—Four-seat Light Training and Sporting aircraft.

WINGS.—Low-wing cantilever monoplane. Be. 1120 wing section. Aspect ratio 6.9. Thickness/chord ratio 15.7% at root, 10% at tips. Dihedral 6.5° on outer wings only. Incidence 2°. All metal structure. Centre-section integral with fuselage. Two-spar outer panels attached to centre-section through three hinges. Interchangeable metal ailerons are fabric-covered. Mechanically-operated all-metal split flaps on outer wings. Fixed trim tab on one side only. Total area of ailerons 0.98 m.² (10.55 sq. ft.). Total area of flaps 1.47 m.² (15.82 sq. ft.). Wing area 14.5 m.² (156 sq. ft.).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—All-metal cantilever monoplane structure. Variable-incidence metal-covered tailplane (range 1.5° up, 8° down). Statically-balanced fabric-covered elevators and rudder are structurally identical. Areas: fin 0.715 m.² (7.69 sq. ft.), rudder 0.585 m.² (6.29 sq. ft.), tailplane 2.6 m.² (27.99 sq. ft.), elevators 1.17 m.² (12.59


The military L-60 Brigadyr (220 h.p. Praga Doris M-208B engine).

sq. ft.). Tailplane span 2.99 m. (9 ft. 10 in.).

LANDING GEAR.—Retractable "reversed tricycle" type, with main wheels retracting backward into the wings and tail-wheel into the fuselage under rear of cabin. Oleo-pneumatic shock-absorbers. Main wheels with 420 × 150 mm. tyres protrude slightly in retracted position to reduce damage to aircraft in belly landing. Tail-wheel tyre 290 × 110 mm. Mechanical brakes. Wheel track 1.88 m. (6 ft. 2 in.). Wheelbase 2.04 m. (6 ft. 8 in.).

POWER PLANT.—One Walter M332 four-cylinder in-line inverted air-cooled supercharged engine, giving take-off power of 140 h.p. at 2,700 r.p.m., rated power of 115 h.p. at 2,500 r.p.m. and cruising power of 100 h.p. at 2,400 r.p.m. Two-blade Type V402 metal three-position variable-pitch airscrew, diameter 1.90 m. (6 ft. 3 in.). Two fuel tanks in wing leading-edges, with total capacity of 110 litres (24.2 Imp. gallons). Oil capacity 10 litres (2.2 Imp. gallons).

ACCOMMODATION.—Enclosed cabin for four persons in two pairs, with separate front seats and bench-type rear seat. Rearward-sliding canopy. Luggage compartment accessible from cabin.

DIMENSIONS.—
Span 10.0 m. (32 ft. 9½ in.).
Length 7.56 m. (24 ft. 9½ in.).
Height 2.47 m. (8 ft. 1 in.).

WEIGHTS AND LOADINGS.—
Weight empty 520 kg. (1,146 lb.).
Useful load 395 kg. (871 lb.).
Weight loaded 920 kg. (2,028 lb.).
Wing loading 63.5 kg./m.² (13.0 lb./sq. ft.).
Power loading 6.6 kg./h.p. (14.55 lb./sq. ft.).



The LD-40 Meta-Sokol (140 h.p. Walter M332 engine).

Power loading 4.55 kg./h.p. (10.03 lb./h.p.).

PERFORMANCE (Z.226B at A.U.W. of 683 kg. = 1,506 lb.).—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Landing speed 78 km.h. (48.5 m.p.h.).
Rate of climb at S/L. 435 m./min. (1,430 ft./min.).
Service ceiling 7,100 m. (23,300 ft.).
Take-off distance from grass 95 m. (312 ft.).
Landing distance, with flaps and brakes 100 m. (330 ft.).
Range 560-720 km. (348-447 miles).

PERFORMANCE (Z.226T at A.U.W. of 818 kg. = 1,803 lb.).—
Max. speed 235 km.h. (146 m.p.h.).
Cruising speed 210 km.h. (130 m.p.h.).



The Zlin 226 Two-seat Trainer (160 h.p. Walter Minor 6-III engine).

PERFORMANCE.—
Max. speed 255 km.h. (158 m.p.h.).
Cruising speed 220 km.h. (137 m.p.h.).
Landing speed 90 km.h. (56 m.p.h.).
Rate of climb at S/L. 270 m./min. (885 ft./min.).
Service ceiling 6,500 m. (21,325 ft.).
Take-off on grass, zero wind 200 m. (655 ft.).
Landing on grass, zero wind 200 m. (655 ft.).
Range 850 km. (530 miles).
Max. endurance 5.5 hours.

THE ZLIN 226.

The Zlin 226 is a further development of the Zlin 26/126 Series, with a more powerful engine and other refinements. It exists in three forms, the Z.226T being the standard trainer version, the Z.226B being fitted with a glider-towing hook and the Z.226A being the single-seat fully-aerobatic trainer. Details are generally as for the Zlin 126, except for the following changes :—

POWER PLANT.—One 160 h.p. Walter Minor 6-III six-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch wooden airscrew which varies in design for each version of aircraft. Fuel in two main wing tanks, each with capacity of 35 litres (7.7 Imp. gallons) and (Z.226B only) one 45 litre (9.9 Imp. gallons) auxiliary tank. System designed to permit inverted flying for 5 minutes.

DIMENSIONS.—
As for Zlin 126 except :
Length 7.80 m. (25 ft. 7 in.).

WEIGHTS AND LOADINGS (Z.226B).—
Weight empty 515 kg. (1,135 lb.).
Normal loaded weight 683 kg. (1,506 lb.).
Max. loaded weight 770 kg. (1,697 lb.).
Wing loading 45.8 kg./m.² (9.46 lb./sq. ft.).
Power loading 4.27 kg./h.p. (9.60 lb./h.p.).

WEIGHTS AND LOADINGS (Z.226T).—
Weight empty 570 kg. (1,257 lb.).
Normal loaded weight 728 kg. (1,605 lb.).
Max. loaded weight 818 kg. (1,803 lb.).
Wing loading 48.9 kg./m.² (10.02 lb./sq. ft.).
Landing speed 78 km.h. (48.5 m.p.h.).
Rate of climb at S/L. 300 m./min. (984 ft./min.).
Service ceiling 5,500 m. (18,040 ft.).
Take-off distance from grass 120 m. (393 ft.).
Landing distance 135 m. (443 ft.).
Range 460 km. (255 miles).
Fuel consumption at cruising speed 32.5 litres/hr. (7.15 Imp. gallons/hr.).

THE ZLIN 126 TRENER Mk. 2.

The Trener Mk. 2 has been developed from the Zlin 26 Trener all-wood basic trainer which has been used for elementary and aerobatic training since 1947. Both the first prototype and first production Trener Mk. 2 flew in 1953.

TYPE.—Two-seat basic Trainer. Fully aerobatic at normal A.U.W. Fitted for glider-towing.

WINGS.—Low-wing cantilever monoplane. All-metal two-spar structure with flush-riveted light alloy stressed skin. Electrically-actuated flaps inboard of ailerons. Gross wing area 14.9 m.² (160.38 sq. ft.).

FUSELAGE.—Welded steel tube structure, upper and lower surfaces covered with easily-removable metal panels and remainder with fabric.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Removable tailplane and fin. Controllable trim-tab in elevator. Areas : tailplane 2.316 m.² (24.92 sq. ft.), fin 1.320 m.² (14.20 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever oleo-pneumatic shock-absorbers attached to front steel centre-section spar which is welded to fuselage. Single-disc mechanical brakes actuated from both cockpits. Fully-castoring self-centering tail-wheel, steerable to 30° either side of centre-line.

POWER PLANT.—One 105 h.p. Walter Minor 4-III four-cylinder in-line inverted air-cooled engine. Fixed-pitch wooden airscrew 2 m. (6 ft. 6¼ in.) diameter. One fuel tank (35 litres = 7.7 Imp. gallons) in each wing root. Gravity tank (7 litres = 1.5 Imp. gallons) interconnected with main tanks and is replenished automatically in flight. Fuel and oil installation designed for aerobatics and permits inverted flying for 4 minutes.

ACCOMMODATION.—Tandem seats under continuous sliding canopy which is jettisonable in an emergency. Windscreen frame reinforced as crash pylon. Complete dual controls and instrumentation. Full standard blind-flying panels. Radio and intercomm. Adjustable seats and rudder pedals in both cockpits. Seat cushions may be replaced by seat type parachutes.

DIMENSIONS.—
Span 10.28 m. (33 ft. 9 in.).
Length 7.55 m. (24 ft. 9 in.).
Height 2.06 m. (6 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 520 kg. (1,146 lb.).
Disposable load 250 kg. (551 lb.).
Weight loaded 770 kg. (1,697 lb.).
Wing loading 51.7 kg./m.² (10.58 lb./sq. ft.).
Power loading 7.34 kg./h.p. (16.15 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 205 km.h. (127 m.p.h.).
Cruising speed (70% rated power) 185 km.h. (115 m.p.h.).
Landing speed 74 km.h. (46 m.p.h.).
Max. permissible diving speed 320 km.h. (200 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min. 50 sec.
Climb to 3,000 m. (9,840 ft.) 24 min. 20 sec.
Service ceiling 4,400 m. (14,435 ft.).
Cruising range 600 km. (373 miles).
Endurance 3.5 hours.
Take-off run from grass 235 m. (765 ft.).
Landing run 150 m. (492 ft.).



The Zlin 126 Trener Mk. 2 (105 h.p. Walter Minor 4-III engine).



The Super Aero 45 Cabin Monoplane (two 105 h.p. Walter Minor 4-III engines).

THE SUPER AERO 45.

TYPE.—Twin-engined 4/5-seat air taxi (ICAO category D).

WINGS.—Cantilever low-wing monoplane. Aero No. 58-64 wing section. Dihedral on outer wings 6°. Incidence 2°. All-metal two-spar structure. I-section spars. Statically and dynamically-balanced ailerons have metal frames and fabric covering. Electrically-operated all-metal split trailing-edge flaps in two sections each side. Total area of ailerons 1.084 m.² (11.67 sq. ft.). Total area of flaps 2.392 m.² (25.75 sq. ft.). Wing area 17.1 m.² (184 sq. ft.).

FUSELAGE.—Metal semi-monocoque structure. Nose section hinged for access to controls and battery.

TAIL UNIT.—All-metal cantilever monoplane type. Fin integral with fuselage. Fixed surfaces metal-covered. Statically and dynamically-balanced rudder and elevators have metal frames and fabric covering. Controllable trim-tabs in rudder and elevators. Areas: fin 0.68 m.² (7.32 sq. ft.), rudder 0.95 m.² (10.23 sq. ft.), tailplane 2.03 m.² (21.85 sq. ft.), elevators 1.30 m.² (13.99 sq. ft.). Tailplane span 3.39 m. (11 ft. 1½ in.).

LANDING GEAR.—Retractable two-wheel type. Oleo-pneumatic shock-absorbers. Electrical operation, with emergency mechanical gear. Low-pressure tyres, 500×180 mm., and hydraulically-operated brakes. Steerable tail-wheel, with oleo-pneumatic shock-absorber, 260×85 mm., linked with rudder control. Wheels can be replaced by skis or floats. Wheel track 2.9 m. (9 ft. 6 in.). Wheelbase 4.995 m. (16 ft. 5 in.).

POWER PLANT.—Two 105 h.p. Walter Minor 4-III four-cylinder in-line inverted air-cooled engines. Two-blade Type V401E wooden four-position variable-pitch airscrews, diameter 1.8 m. (5 ft. 11 in.). Fuel capacity 324 litres (71 Imp. gallons) in four wing tanks. Two oil tanks, each with capacity of 8.5 litres (1.87 Imp. gallons), behind engines. Hand and electric starter.

ACCOMMODATION.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with single or dual controls, and two or three passengers behind on full-width seat. Access door on port side hinges upwards. Front seats adjustable. Cabin heat and sound proofed and ventilated; if desired, also heated. Large luggage compartment behind rear seats. Flight and blind flying instruments. Complete electric equipment. Radio, if desired.

DIMENSIONS.—
Span 12.25 m. (40 ft. 2½ in.).
Length 7.77 m. (25 ft. 6 in.).
Height 2.30 m. (7 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 960 kg. (2,116 lb.).
Crew 310 kg. (684 lb.).
Fuel (174 litres = 38.25 Imp. gallons) 124 kg. (273 lb.).
Oil 15 kg. (33 lb.).
Luggage and radio 91 kg. (200 lb.).
Weight loaded (normal) 1,500 kg. (3,306 lb.).
Weight loaded (full fuel) 1,600 kg. (3,527 lb.).
Wing loading (normal) 87.8 kg./m.² (18.0 lb./sq. ft.).
Power loading (normal) 7.1 kg./h.p. (15.7 lb./h.p.).

PERFORMANCE (at A.U.W. of 1,600 kg. = 3,527 lb.).—
Max. speed 275 km.h. (171 m.p.h.).
Cruising speed (75% power) 230 km.h. (143 m.p.h.).
Landing speed 100 km.h. (62 m.p.h.).
Initial rate of climb 252 m./min. (825 ft./min.).
Service ceiling 5,000 m. (16,400 ft.).
Theoretical ceiling on one engine 1,100 m. (3,600 ft.).
Take-off run from grass (with flaps) to clear 50 ft. (15.25 m.) 565 m. (1,855 ft.).
Landing distance (with flaps) from 50 ft. (15.25 m.) 395 m. (1,295 ft.).
Landing run, with flaps and brakes 225 m. (740 ft.).
Range 1,500 km. (930 miles).
Fuel consumption at cruising speed 50 litres/hour (11 Imp. gallons/hour).

THE AVIA 14.

The Avia 14 is the Czech-built version of the Russian Ilyushin Il-14 twin-engined medium-range airliner. It is structurally similar to the Il-14P of which a detailed description appears in the German section of this work, and its all-metal airframe is built mainly of D1 6T duralumin.

The cabin is ventilated and heated, but not pressurised. It provides standard seating for a crew of five and 28 persons; but by removing the last row of four seats and moving the galley from the front of the cabin to the rear, the capacity of the forward luggage compartment can be doubled. In addition, a de luxe 12-passenger V.I.P. transport version is available with individual cabins containing tables and settees as well as normal seats.

Standard M-82T (ASh-82T) fourteen-cylinder two-row radial engines are fitted, as in the Russian and East German versions.

DIMENSIONS.—
Span 31.7 m. (104 ft. 0 in.).
Length 22.3 m. (73 ft. 2 in.).
Height 7.9 m. (25 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty (24 seats) 12,340 kg. (27,200 lb.).
Weight empty (28 seats) 12,385 kg. (27,300 lb.).
Max. loaded weight 17,240 kg. (38,000 lb.).
Max. landing weight 17,240 kg. (38,000 lb.).
Wing loading 171.4 kg./m.² (35.1 lb./sq. ft.).
Power loading 4.5 kg./h.p. (9.9 lb./h.p.).

PERFORMANCE.—
Max. speed at 2,250 m. (7,400 ft.) 412 km.h. (256 m.p.h.).
Economic cruising speed at 2,000 m. (6,500 ft.) 320 km.h. (200 m.p.h.).
Rate of climb at S/L 365 m./min. (1,200 ft./min.).
Time to 1,000 m. (3,280 ft.) 3.2 min.
Service ceiling 6,700 m. (22,000 ft.).
Service ceiling on one engine 2,450 m. (8,000 ft.).
Take-off run 450 m. (1,470 ft.).
Take-off distance to 15 m. (50 ft.) 900 m. (2,950 ft.).
Landing run 550 m. (1,800 ft.).
Landing distance from 15 m. (50 ft.) 1,000 m. (3,280 ft.).
Range with 24 passengers, with 1 hour fuel reserve 1,600 km. (1,000 miles).
Range with 28 passengers, with 1 hour fuel reserve 1,300 km. (810 miles).
Range of V.I.P. version, with 1 hour fuel reserve 2,200 km. (1,370 miles).

THE HC-2 HELI-BABY.

TYPE.—Two-seat Light helicopter.

ROTOR SYSTEM.—Three-blade main rotor and two-blade anti-torque tail rotor. Main rotor blades of wooden construction with a



The HC-2 Heli-Baby Light Helicopter (83 h.p. Praga DH engine).

steel insert in leading-edge for mass balance and plywood covering armoured with fibreglass. NACA 23015 aerofoil section. Blades fully articulated in flapping and drag planes. Single adjustable friction damper for all three drag hinges. Blades mounted on tubular steel spars incorporating tension-torsion bars. Cyclic pitch change actuated by control stick. Collective pitch lever synchronised with engine throttle. Override settings of throttle by means of twist-grip on pitch control lever. Individually-flapping tail rotor blades of laminated wood with fibreglass covering. Pitch of tail rotor controlled by rudder pedals. Additional horizontal tail surface used during transition from vertical to horizontal flight.

FUSELAGE.—All-metal semi-monocoque structure, with non-stressed cabin enclosure.

LANDING GEAR.—Fixed tricycle type, with castoring nose-wheel capable of swivelling through 360°. Oleo-pneumatic shock-absorbers on all three wheels. All wheels size 260 × 85 mm. Tail-skid to avoid damage to rotor.

POWER PLANT.—One 83 h.p. Praga DH four-cylinder horizontally-opposed fan-cooled engine mounted aft of rotor pylon, with crankshaft centre-line inclined at 45°. Drive from engine taken through centrifugal clutch to main gearbox. Free-wheel in main gearbox for autorotation. Tail rotor driven off main gearbox through universal joint and shafting. Engine/main rotor r.p.m. ratio approximately 10 : 1. Engine/tail rotor r.p.m. ratio approximately 3 : 2. Normal fuel capacity 40 litres (8.8 Imp. gallons). Oil capacity 8 litres (1.76 Imp. gallons).

ACCOMMODATION.—Side-by-side seating for two in cabin with Plexiglas canopy. No doors. Dual overhead cyclic control stick. Collective pitch levers on left side of each seat. Starboard controls quickly removable. Cargo or special equipment space at centre of gravity.

DIMENSIONS.—
Diameter of main rotor 8.80 m. (28 ft. 10 in.).
Diameter of tail rotor 1.30 m. (4 ft. 3 in.).
Overall length 10.47 m. (34 ft. 4 in.).
Overall height 2.55 m. (8 ft. 4 in.).
Overall width 7.90 m. (25 ft. 11 in.).

WEIGHTS.—
Weight empty 380 kg. (838 lb.).
Weight loaded 580 kg. (1,279 lb.).



The HC-2 Heli-Baby Light Helicopter (83 h.p. Praga DH engine).

PERFORMANCE.—
Max. speed 126 km.h. (78 m.p.h.).
Cruising speed 100 km.h. (62 m.p.h.).
Rate of climb at S/L. 215 m./min. (705 ft./min.).
Service ceiling 3,030 m. (9,940 ft.).
Hovering ceiling in ground effect 1,100 m. (3,600 ft.).
Range 150 km. (93 miles).

THE L-13 BLANÍK.

The tandem two-seat L-13 sailplane is designed for training in all categories from elementary to "blind" flying, and for high-performance flight. Fully-aerobatic when flown solo. The prototype completed its flight testing in March, 1956.

WINGS.—Cantilever shoulder-wing monoplane, with 5° forward sweep at quarter-chord. Wing section NACA 63^2A 615 at root, NACA 63^2A 612 at tip. Aspect ratio 13.7. Chord 1.65 m. (5 ft. 5 in.) at root, 0.70 m. (2 ft. 3½ in.) at tip. Dihedral 3°. Incidence 4° at root, 1° at tip. All-metal two-spar structure attached to fuselage at three points. Main spar at 40% chord forms torsion-box with leading-edge. Wing-tip "salmons". Slotted area-increasing flaps. Metal spoilers connected with wheel-brake. Flaps and ailerons fabric-covered. Total area of ailerons 2.31 m.² (24.87 sq. ft.). Total area of flaps 3.95 m.² (42.52 sq. ft.). Total area of spoilers 0.65 m.² (7 sq. ft.). Wing area 19.15 m.² (206.13 sq. ft.).

FUSELAGE. — All-metal semi-monocoque structure of oval cross-section.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Elevator and rudder fabric-covered. Controllable trim-tab in elevator. Horizontal surfaces fold upwards parallel to rudder for transport. Areas: fin 0.71 m.² (7.64 sq. ft.), rudder 0.91 m.² (9.80 sq. ft.), tailplane 1.56 m.² (16.79 sq. ft.), elevators 1.11 m.² (11.95 sq. ft.).

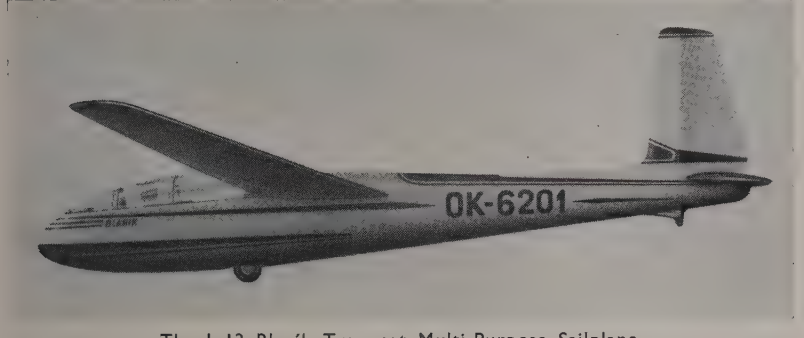
LANDING GEAR.—Mechanically-retractable main wheel, size 350 × 135 mm., on centre-line of fuselage, with oleo-pneumatic shock-absorber and mechanically-actuated brake. Fully-castoring tail-wheel cushioned by rubber shock-absorber and centred by spring.

ACCOMMODATION.—Two seats in tandem in part-upholstered cabin, with heat-insulated walls. Hinged transparent canopy. Complete navigation instruments. Can have electrical horizon, directional gyro, radio and lighting.

DIMENSIONS.—
Span 16.20 m. (53 ft. 2 in.).
Length 8.40 m. (27 ft. 6½ in.).
Height 2.09 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 280 kg. (617 lb.).
Normal loaded weight 470 kg. (1,036 lb.).
Max. loaded weight 500 kg. (1,102 lb.).
Normal wing loading 24.5 kg./m.² (5.02 lb./sq. ft.).
Max. wing loading 26.1 kg./m.² (5.35 lb./sq. ft.).

PERFORMANCE (at A.U.W. of 500 kg. = 1,102 lb.).
Max. gliding ratio at 89 km.h. (55 m.p.h.) 1 : 29.5
Min. rate of descent at 80 km.h. (50 m.p.h.) 0.78 m./sec. (2.56 ft./sec.).
Min. speed (flaps up) 66 km.h. (41 m.p.h.).
Min. speed (flaps down) 54 km.h. (33.5 m.p.h.).
Max. diving speed 240 km.h. (149 m.p.h.).
Max. permissible winch-launching speed 100 km.h. (62 m.p.h.).
Max. permissible aero-tow speed 140 km.h. (87 m.p.h.).
Ultimate load factor 8.



The L-13 Blaník Two-seat Multi-Purpose Sailplane.

DENMARK

KZ

SKANDINAVISK AERO INDUSTRI A/S.

REGISTERED OFFICE : 1 JENS KOFODS GADE, COPENHAGEN K.

WORKS : AIRPORT OF COPENHAGEN, KASTRUP.

Directors : Mogens Harttung, V. Kramme and K. G. Zeuthen

Skandinavisk Aero Industri A/S was founded in 1937 to manufacture light aircraft. The company was financed by a large Danish industrial concern and took over the aircraft manufacturing business formerly conducted by Messrs. Kramme & Zeuthen, who had built the KZ I light single-seat monoplane.

Since its formation the company has built the KZ II two-seat primary trainer, a small series of which was supplied to the Danish Air Force ; the KZ III two-seat and the KZ VII Lark four-seat cabin monoplanes, both of which have been built for domestic, European and overseas markets ; the KZ VIII single-seat aerobatic monoplane ; and the KZ X A.O.P. monoplane, which was a modification of the KZ VII to meet requirements for an artillery observation aircraft.

Detailed descriptions of all these types have appeared in earlier editions of "All the World's Aircraft." Production of them has now ended and, for the time being, Skandinavisk Aero Industri has discontinued its aircraft manufacturing activities.

EGYPT

EGYPTIAN STATE AIRCRAFT FACTORY

HEAD OFFICE AND WORKS : HELIOPOLIS

The Egyptian State Aircraft Factory is producing a version of the wartime German Bücker Bu 181D Bestmann training monoplane under the name of Gomhouria. An initial batch of 60 of the Mk. 1 and Mk. 2 versions was built for the Egyptian Air Force, and three Mk. 2's have been supplied to the Royal Jordanian Air Force.

THE GOMHOURIA (REPUBLIC).

The Egyptian-built Gomhouria is basically similar to the German Bücker Bü 181D Bestmann side-by-side two-seat training monoplane, a full description of which appeared in the 1945-46 edition of "All the World's Aircraft."

Two versions have been produced, as follows :—

Gomhouria Mk. 1. Standard Bestmann with a 105 h.p. Hirth HM 504 four-cylinder in-line inverted air-cooled engine.

Gomhouria Mk. 2. Basically similar to Mk. 1 but re-engined with 145 h.p. Continental C-145 six-cylinder horizontally-opposed air-cooled engine.

DIMENSIONS.—
Span 10.60 m. (34 ft. 9 in.).
Length 7.75 m. (25 ft. 5 in.).
Height 2.10 m. (6 ft. 5 in.).

PERFORMANCE (Gomhouria Mk. 2).—
Max. speed 215 km.h. (134 m.p.h.).
Cruising speed 195 km.h. (121 m.p.h.).
Climb to 3,000 m. (9,840 ft.) 11.7 min.
Service ceiling 5,500 m. (18,050 ft.).
Range 790 km. (490 miles).

FINLAND

EKLUND

TOROLF EKLUND.

HALLI, FINLAND.

Mr. T. Eklund, a Finnish aeronautical engineer, has designed in his spare time a small single-seat amphibian flying-boat which has been built in one of the State Metal Factories.

Known as the TE-1, this aircraft made its first flight on February 24, 1949, powered by a 25-28 h.p. Poinsard flat-twin engine. Because of crankcase failure and the impossibility of getting spares for this obsolete French engine, the TE-1 was later fitted with a 40 h.p. Continental A40 engine and is now flying as the TE-1B with 65 h.p. Walter Mikron III engine.

A full description of the TE-1B appeared in the 1956-57 edition of "All the World's Aircraft."

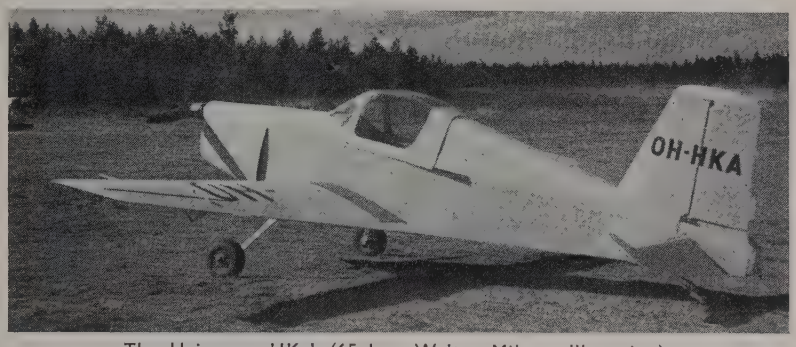
HEINONEN

JUHANI HEINONEN.

ADDRESS: HELSINKI AIRPORT, HELSINKI.

Mr. J. Heinonen, a Finnish aeronautical engineer, former designer at the Valmet Oy Aircraft Factory in Tampere and now employed by Finnair (Aero Oy), has in his spare time designed and built, at the Jämi Soaring School, a small single-seat monoplane, the HK-1. The prototype made its first flight in August, 1954.

On July 10, 1957, Mr. Heinonen flying his HK-1 set up an international distance record for light aircraft weighing less than 500 kg. (1,100 lb.) by flying from Madrid to Turku, Finland (2,844 km.= 1,766 miles) non-stop in 17 hours 1 minute.



The Heinonen HK-1 (65 h.p. Walter Mikron III engine).

THE HEINONEN HK-1.

TYPE.—Single-seat Sports and Aerobatic monoplane.

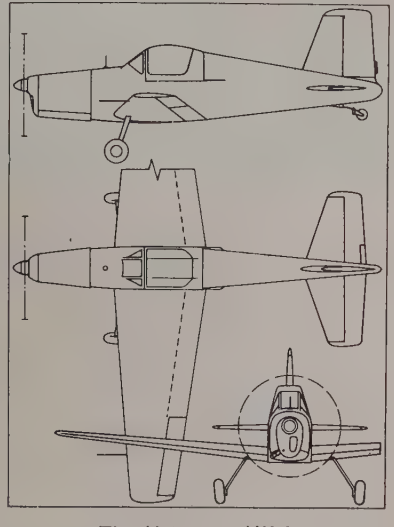
WINGS.—Low-wing cantilever monoplane. Wing section NACA 643A418 (root), NACA 631A412 (tip). Aspect ratio 6.8. Root chord 1.34 m. (4 ft. 5 in.), tip chord 0.615 m. (2 ft.). Dihedral 5°. Incidence (at root) 3°. One piece all-wood wing attached to the fuselage by four bolts. One main spar of I-section. Slotted ailerons are fabric covered. Split flaps are of Alclad sheet and have a duralumin torsion tube. Total flap area 0.94 m.² (10.1 sq. ft.). Total area of ailerons 0.69 m.² (7.4 sq. ft.). Gross wing area 7 m.² (75 sq. ft.).

FUSELAGE.—Plywood covered all-wood structure with four longerons. The frames have straight sides. The fin is integral with the fuselage.

TAIL UNIT.—Cantilever all-wood structure. The rudder and elevator are fabric covered. Adjustable trim-tab in the elevator.

LANDING GEAR.—Fixed tail-wheel type. Cantilever spring steel main legs are attached to the wing. Steerable tail-wheel. Track 2 m. (6 ft. 6 in.).

POWER PLANT.—One 65 h.p. Walter Mikron III four-cylinder in-line inverted air-cooled, or any equivalent engine. Two-blade wooden airscrew 1.53 m. (5 ft.) in diameter. Fuel capacity 58 litres (13 Imp. gallons).



The Heinonen HK-1.

ACCOMMODATION.—Rearward sliding canopy is made of Perspex. Luggage compartment 0.14 m.³ (5 cub. ft.) is behind the seat. The crash pylon is made of steel tube.

DIMENSIONS.—
Span 6.9 m. (22 ft. 6 in.).
Length 5.35 m. (17 ft. 6 in.).
Height (from airscrew tip) 2.1 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 250 kg. (550 lb.).
Weight loaded (aerobatic category) 360 kg. (795 lb.).
Weight loaded (normal category) 400 kg. (880 lb.).
Wing loading (aerobatic category) 51.4 kg./m.² (10.5 lb./sq. ft.).
Power loading (aerobatic category) 5.53 kg./h.p. (12.2 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 215 km.h. (135 m.p.h.).
Cruising speed at S/L. 185 km.h. (115 m.p.h.).
Landing speed 75 km.h. (47 m.p.h.).
Rate of climb at S/L. 270 m./min. (880 ft./min.).
Max. range 700 km. (430 miles).
Take-off distance to 15.25 m. (50 ft.) in still air 240 m. (789 ft.).
Landing distance from 15.25 m. (50 ft.) in still air 350 m. (1,155 ft.).

PIK

POLYTEKNIKKOJEN ILMAILUKERHO (THE FLYING CLUB OF THE FINNISH INSTITUTE OF TECHNOLOGY).

ADDRESS: LÖNNROTINKATU 29, HELSINKI.

This club was established in 1931 and has since been engaged mainly in gliding activities. Of the series of gliders designed and constructed, the primary glider PIK-7, the intermediate types PIK-5a, b, and c and the advanced sailplanes PIK-3a and b are of particular interest due to the fact that they have been accepted as standard types for Finnish Gliding Clubs. The first Finnish two-seat sailplane, the PIK-12, was completed and flown in May, 1956.

The first powered aeroplane to be built in the club was the PIK-11, which flew in March, 1953.



The PIK-11 Single-seat Light Monoplane (65 h.p. Continental A65 engine).

THE PIK-11.

TYPE.—Single-seat Light Sports monoplane.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 2415/4409R. Aspect ratio 7.1. Root chord 1.5 m. (4 ft. 11 in.), tip chord 0.75 m. (2 ft. 5½ in.). Dihedral 6°. One piece single box-spar with plywood-covered leading edge D-section. Fabric covering aft of spar. Auxiliary spar carries slotted fabric-covered ailerons. No flaps. Gross wing area 9.0 m.² (97 sq. ft.).

FUSELAGE.—All-wood semi-monocoque structure.

TAIL UNIT.—One-piece cantilever tailplane with plywood skin. Fin integral with fuselage. Movable surfaces fabric-covered. Controllable trim-tab in elevator. Horizontal tail area 1.56 m.² (16.8 sq. ft.), span 2.35 m. (7 ft. 8½ in.).

LANDING GEAR.—Spring steel type. No brakes. Steerable tail-wheel.

POWER PLANT.—One 65 h.p. Continental A65-8 four-cylinder horizontally-opposed air-cooled engine, driving a two-blade fixed-pitch wood airscrew. Airscrew diameter 1.6 m. (5 ft. 3 in.). Fuel tank (capacity 65 litres=14.3 Imp. gallons) in fuselage behind the firewall.

ACCOMMODATION.—Single-seat cockpit with jettisonable Perspex canopy.

DIMENSIONS.—
Span 8.0 m. (26 ft. 3 in.).
Length 5.5 m. (18 ft.).
Height 1.65 m. (5 ft. 5 in.).

WEIGHTS AND LOADINGS.—
Weight empty 238 kg. (525 lb.).
Weight loaded 373 kg. (825 lb.).
Wing loading 41 kg./m.² (8.5 lb./sq. in.).
Power loading 5.65 kg./h.p. (12.7 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 220 km.h. (137 m.p.h.).
Cruising speed at S/L. 170 km.h. (106 m.p.h.).
Landing speed 80 km.h. (50 m.p.h.).
Initial rate of climb 330 m./min. (1,080 ft./min.).
Climb to 1,000 m. (3,300 ft.) 3 min. 10 sec.
Climb to 5,000 m. (16,500 ft.) 31 min.
Range 700 km. (430 miles).
Take-off run to clear 50 ft. (no wind) 300 m. (985 ft.).

THE PIK-12.

TYPE.—Two-seat training Sailplane.
WINGS.—High-wing semi-cantilever monoplane. Wing section Gö 533. Aspect ratio 12.8. Chord 1.5 m. (4 ft. 11 in.) at root, 0.8 m. (2 ft. 7½ in.) at tip. All-wood structure. Fabric-covered slotted ailerons. Air brakes on upper surface of wings. Gross wing area 20 m.² (215.2 sq. ft.).
FUSELAGE. — All-wood plywood-covered structure.
TAIL UNIT.—Cantilever monoplane type. Wood frames, plywood-covered fixed surfaces, fabric-covered movable surfaces.
LANDING GEAR.—Wood skid, single wheel and tail-skid. Rubber springing.



The PIK-12 Two-seat Training Sailplane

ACCOMMODATION.—Tandem seats beneath hinged canopy.
DIMENSIONS.—
Span 16 m. (42 ft. 6 in.).
Length 7.4 m. (24 ft. 3½ in.).
Height 1.55 m. (5 ft. 1 in.).
WEIGHTS (2-seater).—
Weight empty 185 kg. (407 lb.).
Weight loaded 360 kg. (792 lb.).
Wing loading 18 kg./m.² (3.68 lb./sq. ft.).
PERFORMANCE (2-seater).—
Best glide ratio 23 at 65 km.h. (40.4 m.p.h.).
Min. sinking speed 0.75 m./sec. (2.4 ft./sec.) at 58 km.h. (36 m.p.h.).

VALMET

VALMET OY, LENTOKONETEHDAS (Aircraft Factory).

OFFICE AND WORKS : TAMPERE.

The Aircraft Factory forms part of the concern known as the State Metal Works, which was established by bringing the former State Aircraft Factory and several other State-owned metal-working factories under a central management. The present Aircraft Factory, a direct continuation of the former State Aircraft Factory, belongs to the Tampere Factory Group which consists of the Aircraft Factory at Tampere, as the central unit, and the Kuorevesi Factory which undertakes aircraft repairs. The Linnavuori Factory at Siuro, near Tampere, is producing chiefly engines.

The recent production activities of the Aircraft Factory have been concentrated on the Vihuri, a two-seat advanced training monoplane. The prototype VH-I flew for the first time on February 6, 1951. The first series of the Vihuri was produced for the Finnish Air Force in a slightly modified form as the Vihuri VH-II. The first production VH-II was flown on August 3, 1953.

A second slightly-modified series of the Vihuri was produced for the Finnish Air Force as the Vihuri-III. This series was completed and delivered during the latter half of 1956.

The Factory is also building for the Finnish Air Force the prototype of a primary trainer known as the Tuuli-III.

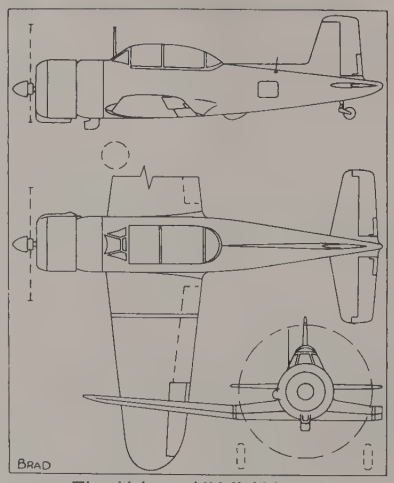
A licence for the manufacture of the Folland Gnat light fighter was acquired in 1957.

THE VALMET TUULI-III.

TYPE.—Three-seat Primary/two-seat Aerobatic Trainer.
WINGS.—Low-wing cantilever monoplane. All-metal single-spar structure. Alclad-covered all-metal slotted flaps and ailerons. Gross wing area 17 m.² (182 sq. ft.).
FUSELAGE.— Monocoque structure with frames, stringers and Alclad skin.
TAIL UNIT.—Cantilever monoplane type.



The Valmet VH-II Vihuri Advanced Trainer (820 h.p. Bristol Mercury engine).



The Valmet VH-II Vihuri.

LANDING GEAR.—Retractable tail-wheel type. Hydraulically operated brakes controlled by toe-pedals.
POWER PLANT.—One 225 h.p. Continental O-470 six-cylinder horizontally-opposed air-cooled engine. Hartzell two-blade constant-speed airscrew.
ACCOMMODATION.—Two seats side-by-side in front with dual controls. Adjustable seats and foot pedals. Heating and ventilation. VHF, Radio compass. Baggage compartment.
DIMENSIONS.—
Span 11.0 m. (36 ft. 1 in.).
Length 8.0 m. (26 ft. 3 in.).
WEIGHTS AND PERFORMANCE.—
No data available.

THE VALMET VH-II VIHURI (SQUALL).

TYPE.—Two-seat Advanced Trainer.
WINGS.—Low-wing cantilever monoplane. Wing section NACA 0019-64 (root), NACA 23009 (tip). Aspect ratio 5.7. Chord 2.49 m. (7 ft. 7 in.) at root, 1.2 m. (3 ft. 8 in.) at tip. Dihedral (outer wings) 5°. Incidence (at root chord) 3°. Sweepback 4° at 25% chord. Light alloy stressed-skin structure. Modified Frise-type ailerons have light-alloy frames and fabric covering. Light alloy split flaps inboard of ailerons. Total area of ailerons 1.46 m.² (15.7 sq. ft.). Total area of flaps 1.85 m.² (19.9 sq. ft.). Gross wing area 18.86 m.² (202.9 sq. ft.).
FUSELAGE.—Forward section of fuselage is a welded chrome-molybdenum steel tube structure with Alclad covering. Rear section is a light metal stressed-skin monocoque.
TAIL UNIT.—Light alloy stressed-skin structure. Areas : fin 2.61 m.² (28.0 sq. ft.), rudder 0.82 m.² (8.8 sq. ft.), tailplane 2.79 m.² (20.0 sq. ft.), elevators (total) 1.21 m.² (13.0 sq. ft.). Tailplane span 3.74 m. (12 ft. 3 in.).
LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Valmet oil/spring shock-absorbers. Valmet wheels, Dunlop tyres and Valmet hydraulic brakes. Track 2.64 m. (8 ft. 8 in.).
POWER PLANT.—One Bristol Mercury VIII nine-cylinder radial air-cooled engine rated at 820 h.p. at 2,650 r.p.m. at 4,100 m. (13,450 ft.) and with a maximum take-off power of 720 h.p. at 2,650 r.p.m. at sea level. Modified three-blade D.H. constant-speed metal airscrew. Two main rubber bag tanks (195 litres = 43 Imp. gallons each) and two auxiliary tanks (130 litres = 28.6 Imp. gallons each) in centre-section. Total fuel capacity 630 litres (138 Imp. gallons). Oil capacity 30 litres (6.5 Imp. gallons).
ACCOMMODATION.—Enclosed cockpit seating two in tandem (pupil in front) with dual



The Valmet VH-III Vihuri Advanced Trainer (820 h.p. Bristol Mercury engine).

controls. Sliding jettisonable Perspex canopy. Seats and rudder-pedals are adjustable. Provision for amber screening for blind-flying training. 24-volt electrical system. VHF transmitter/receiver, blind-approach equipment and radio compass.

DIMENSIONS.—
Span 10.4 m. (33 ft. 1 in.).
Length 8.8 m. (28 ft. 9 in.).
Height 3.86 m. (12 ft. 8 in.).

WEIGHTS AND LOADINGS.—
Max. loaded weight (normal fuel) 2,678 kg. (5,892 lb.).
Max. loaded weight (with auxiliary fuel) 2,884 kg. (6,345 lb.).
Wing loading (normal fuel) 142 kg./m.² (29.11 lb./sq. ft.).
Power loading (normal fuel) 3.26 kg./h.p. 7.17 lb./h.p.).

PERFORMANCE (at 2,678 kg. = 5,892 lb. A.U.W.).—
Max. speed 432 km.h. (268 m.p.h.) at 3,700 m. (12,140 ft.).
Econ. cruising speed 327 km.h. (203 m.p.h.)
Landing speed 135 km.h. (83.8 m.p.h.).
Initial rate of climb 690 m./min. (2,263 ft./min.).
Rate of climb at 3,700 m. (12,140 ft.) 660 m./min. (2,165 ft./min.).
Service ceiling 8,900 m. (29,190 ft.).
Take-off to 15.25 m. (50 ft.) 700 m. (765 yds.).
Landing distance from 15.25 m. (50 ft.) 750 m. (820 yds.).

THE VALMET VH-III VIHURI (SQUALL).

TYPE.—Two-seat Advanced Trainer.

WINGS.—Same as for VH-II, except spring-tab ailerons instead of modified Frise-type.

FUSELAGE.—Same as for VH-II.

TAIL UNIT.—Same as for VH-II.

LANDING GEAR.—Same as for VH-II, except wheels, tyres and disc brakes all made by Dunlop.

POWER PLANT.—Same as for VH-II.

ACCOMMODATION.—Same as for VH-II, but without blind-approach equipment.

ARMAMENT.—One 7.7 mm. machine-gun in each wing. Gyro gun-sight. Camera recorder. Attachment points for 2 × 25 kg. bombs under each wing.

DIMENSIONS.—
Same as for VH-II.

WEIGHTS AND LOADINGS.—
Max. weight loaded (normal fuel, full armament) 2,880 kg. (6,340 lb.).

PERFORMANCE.—
Same as for VH-II.

FRANCE

AUBERT

AVIONS PAUL AUBERT.

HEAD OFFICE: 6, SQUARE CLAUDE DEBUSSY, PARIS (17E).

WORKS: BUC AERODROME, NEAR VERSAILLES (SEINE-ET-OISE).

M. Paul Aubert, a pilot of the 1914-18 war, formed Aubert-Aviation in 1932 and in 1936 began the design of aircraft. The first aircraft he built was the PA-20 Cigale, a side-by-side trainer which, after successful trials, was exhibited at the 1938 Paris Salon.

In 1938 Aubert-Aviation became the Société Anonyme des Avions P. Aubert. Considerable sub-contract work was undertaken for the nationalised aircraft industry and a direct contract for production of a number of Morane-Saulnier M.S. 230 trainers was placed with the company by the French Government. All this work ceased in June, 1940.

After the war Aubert revised the PA-20, the prototype of which had been destroyed during the occupation. In its revised form as the PA-201, and powered by a 140 h.p. Renault engine, it won many competitions.

The current development of this original design is the PA-204 Super Cigale, the prototype of which flew in April, 1949 and received its Certificate of Airworthiness in November, 1951.

THE AUBERT CIGOGNE.

The Cigogne, which is now under development, will be a twin-engined six-seat executive type aircraft of mixed wood and metal construction. It will be a high-wing monoplane with a retractable tricycle landing-gear and will be powered by two Lycoming engines (180 to 240 h.p.).

No further details were available at the time of closing for press.

THE AUBERT PA-204 SUPER CIGALE.

The Super Cigale was designed and built originally with a 180 h.p. SNECMA engine, but is now available with Lycoming engines of from 135 to 180 h.p. The prototype 135 h.p. version flew for the first time on July 27, 1955, and featured



The Aubert Super Cigale (150 h.p. Lycoming engine). (*J. W. R. Taylor*).

a wider cabin with better forward view than the earlier prototype.

A batch of thirty of the revised model was put in hand, including eight for the Aéro-Club Air France, and production was continuing through 1957.

TYPE.—Four-seat Touring monoplane.

WINGS.—High-wing cantilever monoplane. Aspect ratio 7.8. One-piece all-wood wing with elliptical outer sections. Entire trailing-edge hinged, outer sections as ailerons, inner sections as flaps. Gross wing area 12.92 m.² (139 sq. ft.).

FUSELAGE.—All-wood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Adjustable tailplane. Areas: fin 0.59 m.² (6.35 sq. ft.), rudder 0.77 m.² (8.28 sq. ft.), tailplane 1.55 m.² (16.62 sq. ft.), elevators 1.65 m.² (17.75 sq. ft.). Tailplane span 3.80 m. (12 ft. 5½ in.).

LANDING GEAR.—Fixed tail-wheel type. Main cantilever legs are sprung within the fuselage by rubber blocks. Orientable tail-wheel. Track 2.80 m. (9 ft. 2 in.).

POWER PLANT.—One 150 or 180 h.p. Lycoming four-cylinder horizontally-opposed air-cooled engine driving a Hartzell two-blade constant-speed airscrew. Two fuel tanks (75 litres = 16.5 Imp. gal. each) in wing, one on each side of fuselage.

ACCOMMODATION.—Enclosed cabin seating four in two pairs. Alternatively, can accommodate pilot and one stretcher in ambulance rôle, or 300 kg. (660 lb.) of freight. Two upward-hinged doors, one on each side. Cabin is sound-proofed and air conditioned. The seats are upholstered in Dunlopillo.

DIMENSIONS.—
Span 10.0 m. (32 ft. 9 in.).
Length 7.50 m. (24 ft. 7 in.).
Height 2.40 m. (7 ft. 10 in.).

WEIGHTS.—
Weight empty 640 kg. (1,408 lb.).
Weight loaded 1,250 kg. (2,755 lb.).

PERFORMANCE (150 h.p. Lycoming).—
Max. speed 255 km.h. (158 m.p.h.).
Cruising speed (70% power) 230 km.h. (143 m.p.h.).
Landing speed 90 km.h. (56 m.p.h.).
Rate of climb at S/L. 270 m./min. (885 ft./min.).
Service ceiling 4,500 m. (14,750 ft.).
Take-off distance 230 m. (755 ft.).
Landing distance 120 m. (395 ft.).
Range 1,880 km. (1,168 miles).
Fuel consumption 32 litres/hr. (7.04 Imp. gal./hr.).

PERFORMANCE (180 h.p. Lycoming).—
Max. speed 270 km.h. (168 m.p.h.).
Cruising speed 245 km.h. (153 m.p.h.).
Landing speed 90 km.h. (56 m.p.h.).
Rate of climb at S/L. 300 m./min. (985 ft./min.).
Service ceiling 5,000 m. (16,400 ft.).
Take-off distance 200 m. (655 ft.).
Landing distance 120 m. (395 ft.).
Range 1,880 km. (1,168 miles).
Fuel consumption 36 litres/hr. (7.9 Imp. gal./hr.).

BOISAVIA

SOCIÉTÉ BOISAVIA.

HEAD OFFICE: 11, RUE PIERRE-BROSSOLETTE, IVRY-SUR-SEINE.

The principal product of Boisavia, which was founded in 1948 and is under the direction of M. Lucien Tielès, is the B.60 Mercurey, a four-seat cabin monoplane which has been developed from the earlier B.50 Muscadet three-seater.

The latest production is the B.260 Anjou, a twin-engined cabin monoplane, the prototype of which made its first flight on June 2, 1956. Boisavia has an agreement with S.N.C.A.N. whereby it has the use of the workshops, machinery and personnel of the latter company's plant at Méaulte for the construction of two prototypes and a pre-series of three Anjous. A seven-seat version with more powerful engines is under development.

THE BOISAVIA B.260 ANJOU.

The first prototype of the four-seat B.260 Anjou made its first flight on June 2, 1956, powered by two 170 h.p. SNECMA-Régnier 4LO2 engines. It will be followed by a second prototype with 170 h.p. Lycoming O-340 engines and a pre-series of three production Anjous. A seven-seat version with 220 h.p. Potez 4D.31 engines is also under development.

The wing-tip "balonets" have an aerodynamic function by increasing the effective wing-span, and are used also as auxiliary fuel tanks.

TYPE.—Twin-engined Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 7.6. Chord 1.70 m. (5 ft. 7 in.). Dihedral 5°. Incidence 3° 30′. Two-spar metal structure. Metal covered, except for some fabric covering between the spars outboard of the engines. All-metal ailerons. Electrically-operated all-metal flaps, with manual emergency control. Total area of ailerons 2.0 m.² (21.53 sq. ft.). Total area of flaps 2.4 m.² (25.83 sq. ft.). Gross wing area 21.5 m.² (231.42 sq. ft.).

FUSELAGE.—Steel tube structure, with metal covering.

TAIL UNIT.—Cantilever monoplane type. All-metal construction. Areas: fin 2.0 m.² (21.53 sq. ft.), rudder 0.7 m.² (7.53 sq. ft.), tailplane 2.16 m.² (23.25 sq. ft.), elevators 3.52 m.² (37.89 sq. ft.).

LANDING GEAR.—Retractable tricycle type. Boisavia oleo-pneumatic shock-absorbers. Electric retraction, with manual emergency control. Boisavia wheels size 550×175. Hydraulic brakes. Wheel track 3.50 m. (11 ft. 6 in.).

POWER PLANT.—Two 170 h.p. SNECMA-Régnier 4LO2 four-cylinder in-line inverted air-cooled engines, driving two-blade Hartzell variable-pitch metal airscrews, or two 170 h.p. Lycoming O-340 four-cylinder horizontally-opposed air-cooled engines. Fuel in two wing tanks with total capacity of 450 litres (99 Imp. gallons) and two wing-tip tanks with total capacity of 200 litres (44 Imp. gallons). Oil capacity 14 litres (3 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating four persons. Starboard front seat and the rear bench-type seat can be removed for cargo carrying. Floor is stressed to bear heavy concentrated loads.

DIMENSIONS.—
Span 13 m. (42 ft. 8 in.).
Length 7.20 m. (23 ft. 7 in.).
Height 3 m. (9 ft. 10 in.).

WEIGHTS.—
Weight empty 1,300 kg. (2,866 lb.).
Weight loaded 2,000 kg. (4,410 lb.).

PERFORMANCE.—
Max. speed 300 km.h. (186 m.p.h.).
Economical cruising speed 240 km.h. (149 m.p.h.).
Min. speed 90 km.h. (56 m.p.h.).
Ceiling 6,800 m. (22,300 ft.).
Take-off run 160 m. (525 ft.).
Landing run 150 m. (490 ft.).
Range 1,500 km. (930 miles).
Rate of climb on one engine at 1,500 m. (5,000 ft.) 50 m./min. (165 ft./min.).

THE BOISAVIA B.60 MERCUREY.

Apart from the basic B.60 Mercurey, the prototype of which first flew in March, 1948 and has been followed by 28 production models, the following variants have been built:—

B.601. Agricultural version of the B.60. Fitted with a 190 h.p. Lycoming engine.

B.602. Similar to B.60 but fitted with a 165 h.p. Continental engine.

B.603. Developed specifically as a glider-tug, with increased wing span. Powered by a 240 h.p. Argus As 10 engine.

Prototype flew on April 11, 1951 and first production B.603 in 1952. In official tests, towing a Nord 2000 sailplane, the B.603 has taken off in 120 m. (393 ft.) climbed to 1,000 m. (3,280 ft.) in 3½ minutes and reached 5,600 m. (18,370 ft.) in 56 minutes. Five ordered by S.F. A.S.A.

B.604. Glider-tug. Development of the B.603 with longer fuselage, higher fin and a new landing gear. Powered by a 230 h.p. Salmson 9 Abc radial engine. Prototype flew on January 6, 1954.

B.605. Four-seat tourer and trainer. Similar to B.60 except fitted with 170 h.p. SNECMA Regnier 4L 02 engine. First flew on April 29, 1954.

TYPE.—Four-seat Cabin monoplane.

WINGS. — High-wing rigidly-braced monoplane. NACA 23.012 wing section. Aspect ratio 7.1 (7.5 on B.603). Chord 1.60 m. (5 ft. 3 in.). Dihedral 1° 30′. Incidence 3° 30′. Two-spar wooden structure with stressed plywood skin. Vee bracing-struts. Slotted aerodynamically-balanced ailerons. Built-in leading-edge slots ahead of ailerons. Trailing-edge flaps between ailerons 152 fuselage. Total area of ailerons 1.52 m.² (16.36 sq. ft.). Total area of flaps 2.30 m.² (24.76 sq. ft.). Wing area 18 m.² (193.6 sq. ft.) (19.20 m.² = 206.66 sq. ft. on B.603).

FUSELAGE. — Welded steel-tube structure covered with fabric.

TAIL UNIT.—Cantilever monoplane type. Tailplane structure similar to that of wings. Balanced elevators and rudder. Trim-tabs, adjustable on ground, in port elevator and rudder. Areas: fin 1.5 m.² (16.15 sq. ft.), rudder 0.65 m.² (7.0 sq. ft.), tailplane 1.45 m.² (15.60 sq. ft.), elevators 2.90 m.² (31.20 sq. ft.).

LANDING GEAR.—Fixed type with divided axle. Sandows shock-absorbers. Boisavia wheels size 550 × 175. Hydraulic brakes. Steerable tail-wheel. Wheel track 2.50 m. (8 ft. 2½ in.).

POWER PLANT (B.60).—One 150 h.p. Lycoming O-320 or 170 h.p. Lycoming O-340 four-cylinder horizontally-opposed air-cooled engine, driving a Ratier metal airscrew. Fuel in two wing tanks with total capacity of 220 litres (48.4 Imp. gallons). Oil capacity 7 litres (1.5 Imp. gallons).

POWER PLANT (B.603).—One 240 h.p. Argus As.10 engine driving Merville wooden airscrew. Fuel as in B.60. Oil capacity 15 litres (3.3 Imp. gallons).



The Boisavia B.60 Mercurey (150 h.p. Lycoming O-320 engine).

ACCOMMODATION.—Cabin seats four in two pairs with dual controls to the front pair. One-piece windscreen, transparent roof and fairing over rear seats. Large door on each side opens upward for access to both front and rear seats. Baggage compartment at back of cabin accessible from inside. Soundproofing, heating and ventilation. Passenger seats quickly removable so that cabin may be used for light freight.

DIMENSIONS (B.60).—
Span 11.38 m. (37 ft. 4 in.).
Length 7.20 m. (23 ft. 7 in.).
Height 2.20 m. (7 ft. 3 in.).

DIMENSIONS (B.603).—
Span 12.0 m. (39 ft. 4½ in.).
Length 7.70 m. (25 ft. 3 in.).
Height 2.20 m. (7 ft. 3 in.).

WEIGHTS (B.60).—
Weight empty 710 kg. (1,565 lb.).
Weight loaded 1,277 kg. (2,815 lb.).

WEIGHTS (B.603).—
Weight empty 830 kg. (1,830 lb.).
Weight loaded 1,277 kg. (2,815 lb.).

PERFORMANCE (B.60).—
Max. speed 235 km.h. (146 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Stalling speed 70 km.h. (43.5 m.p.h.).
Ceiling 5,500 m. (18,040 ft.).
Take-off run 210 m. (690 ft.).
Landing run 150 m. (490 ft.).
Range 1,200 km. (745 miles).

PERFORMANCE (B.603).—
Max. speed 245 km.h. (152 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Stalling speed 70 km.h. (43.5 m.p.h.).
Ceiling 5,500 m. (18,040 ft.).
Take-off run 150 m. (490 ft.).
Landing run 150 m. (490 ft.).
Range 800 km. (500 miles).



The Boisavia B.603 Mercurey Glider-tug (240 h.p. Argus engine).

BREGUET

SOCIÉTÉ ANONYME DES ATELIERS D'AVIATION LOUIS BREGUET.

HEAD OFFICE: 24, RUE GEORGES-BIZET, PARIS (XVIe).

WORKS: VILLACOUBLAY (SEINE-ET-OISE), TOULOUSE (HAUTE-GARONNE), BAYONNE (BASSES-PYRÉNÉES) AND AIRE-SUR-ADOUR.

President and Director-General: Sylvain Floirat.

General Manager: Henri Ziegler.

The Breguet company was founded in 1911 by M. Louis Breguet, one of the great pioneers of French aviation, who died on May 4, 1955, at the age of 75.

The two main factories of the Breguet company were incorporated into the nationalised industry in 1936, but three years later it regained some measure of independence through the purchase of the former Latécoère factories at Toulouse, Bayonne and Biscarosse.

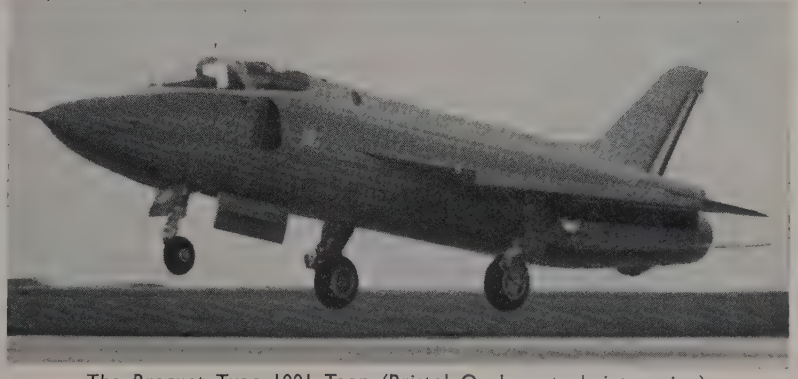
Breguet is developing the single-engined Type 1001 and twin-engined Type 1100 tactical support aircraft to N.A.T.O. and French Air Force specifications respectively; and the Type 1050 anti-submarine "hunter-killer" for the French Navy. An initial production order for a small number of Type 1050 aircraft has been followed by a much larger contract to equip the aircraft carriers now in service with the French Navy and the two new carriers under construction.

Breguet is also developing a family of aircraft which will employ the "blown-wing" principle of high lift to provide short take-off and landing runs. The principle involves the use of four large diameter airscrews, equally distributed spanwise, and large double flaps. The slipstream of the airscrews gives, even at zero forward speed, an important amount of lift. The first aircraft in this series will be the Type 940, a turboprop freighter designed to carry a load of 3 tons over a range of 960 km. (600 miles), and to take off with full load in less than 55 m. (60 yards). The Type 941 will be a military assault-transport of similar configuration to the Type 940, but larger.

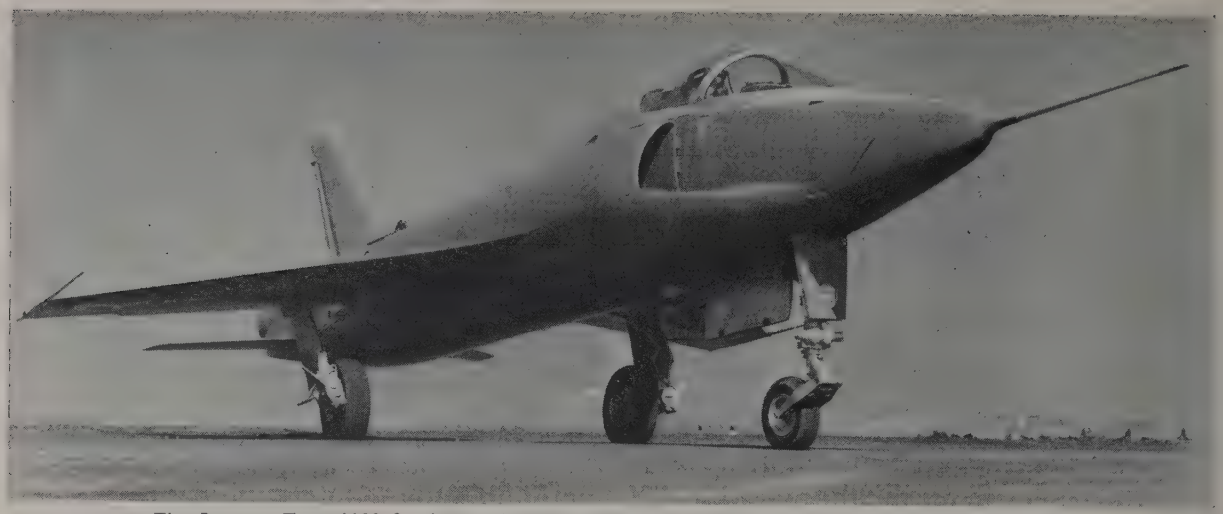
Breguet is building, in its Anglet plant, wings for the Nord 2501 twin-engined transport which is in production for the French Air Force. It is also producing in series, under a Rotol licence, the airscrews for this transport.

The Breguet Light Aircraft Department, under the technical direction of M. Jarlaud, the well-known specialist in high-performance sailplanes, was transferred to Aire-sur-Adour in 1957.

The prototype of the Type 901 sailplane was entered in the International Gliding Championship Meeting held in England in July-August, 1954, and won the single-seat class.



The Breguet Type 1001 Taon (Bristol Orpheus turbojet engine).



The Breguet Type 1100 Single-seat Light Fighter (two Turbomeca Gabizo turbojet engines).

In the 1956 World Championships in France, the production Type 901S won the single-seat class. The Type 904 two-seat high-performance sailplane is also in production and deliveries began in 1956.

Prototype sailplanes under development include the Type 902 two-seat high-performance trainer and the S.10 stratospheric research sailplane with a pressurised cabin.

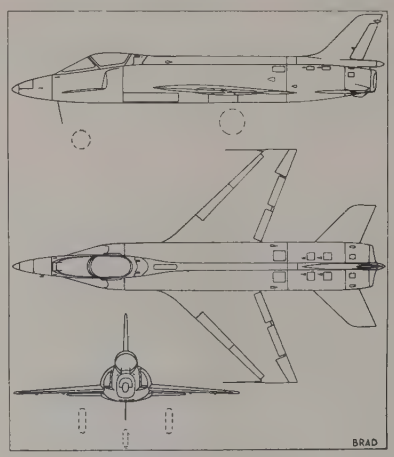
Early in 1957, Breguet acquired a financial interest in the Société Matra and it was announced that the two companies would work together on aircraft and missiles.

THE BREGUET TYPE 1001 TAON.

The Type 1001 is a single-seat lightweight ground attack fighter which has been designed to meet the NATO specification for a tactical fighter, with emphasis on maximum speed at sea level, high manoeuvrability in roll and good take-off and landing performances on unprepared strips In the evaluation of the designs by NATO, the Type 1001 was placed first. Three prototypes have been ordered, and the first of these flew on July 26, 1957.

The Taon (Gadfly or Horsefly) is a small swept-wing monoplane powered by a Bristol Orpheus turbojet engine. All wheels of the tricycle landing-gear retract into the fuselage.

The prototype, with an Orpheus 3 turbojet (2,200 kg.=4,850 lb. s.t.) has a wing area of 14.7 m.² (158 sq. ft.); but it will have a wing area of 20 m.² (215 sq. ft.), like the Breguet 1100, when fitted with an Orpheus 12 of much higher power.



The Breguet Type 1100.

DIMENSIONS.—
Length 11.30 m. (37 ft. 1 in.).
Height 3.70 m. (12 ft. 1½ in.).

WEIGHT.—
Weight loaded approx. 5,000 kg. (11,025 lb.).

THE BREGUET TYPE 1100.

The Type 1100 is a pressurised twin-engined version of the Type 1001 which has been designed to a French Air Ministry specification. It is powered by two Turbomeca Gabizo turbojet engines with afterburning, the engines being located in the centre fuselage with paired jet pipes terminating side-by-side aft of the tail unit. Construction is entirely of bonded metal, with extensive use of honeycomb sandwich, and the fuselage is "waisted" in accordance with the Area Rule.

The Type 1100 has large-span narrow-chord wing flaps and wide-chord short-span ailerons, with spoilers forward of the flaps. All its controls are powered. A choice of sixteen different armament combinations is available, including four 0.5 in. Browning or two 30 mm. DEFA guns or a Matra fuselage pack of 35 unguided rockets, plus under-wing stores.

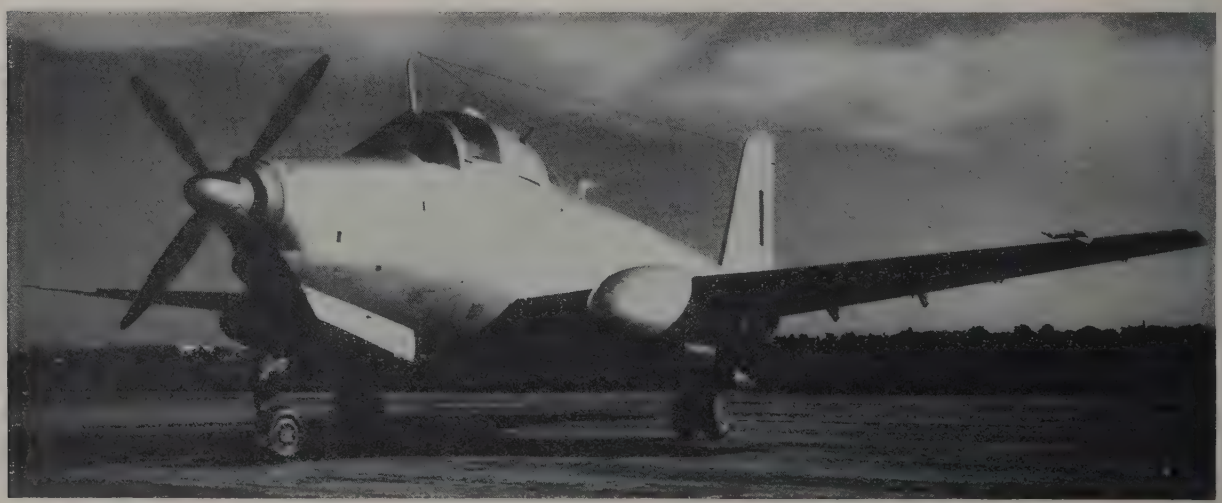
Three prototypes have been ordered, including one (Type 1100M) for the French Navy, and the first of these exceeded Mach 1 during its first flight on March 31, 1957.

DIMENSIONS.—
Span 7.80 m. (25 ft. 7 in.).
Length 12.60 m. (41 ft. 0 in.).
Height 4.35 m. (14 ft. 3 in.).
Wing area 20 m.² (215 sq. ft.).

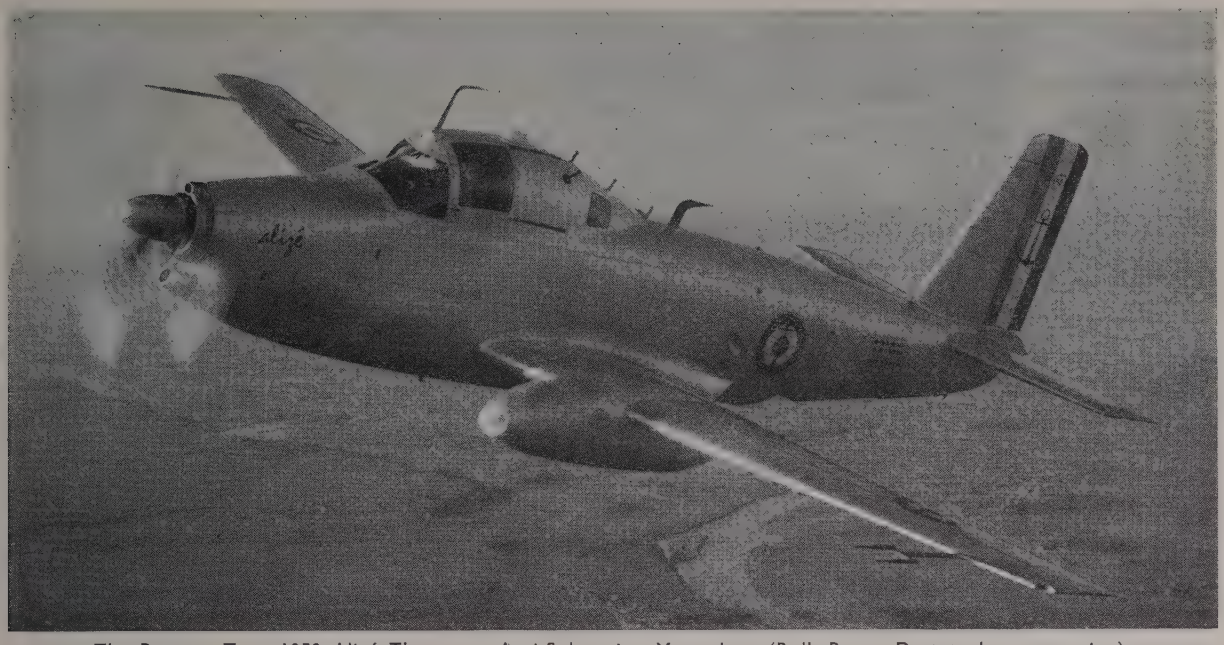
WEIGHT.—
Weight loaded approx. 6,000 kg. (13,230 lb.).

THE BREGUET TYPE 1050 ALIZÉ.

The Type 1050 Alizé (Trade-wind) is a three-seat anti-submarine "hunter-killer" carrier-based aircraft derived from the Type 960 Vultur, which has been described in earlier editions of "All the World's Aircraft." The Nene engine which was mounted in the rear fuselage of the Type 960 has been removed and replaced by a retractable radar scanner. The airframe is lighter and the landing-gear simplified. The wings and tail-unit also differ from those of the Type 960.



The Breguet Type 1050 Alizé Three-seat Anti-Submarine Monoplane (Rolls-Royce Dart turboprop engine).



The Breguet Type 1050 Alizé Three-seat Anti-Submarine Monoplane (Rolls-Royce Dart turboprop engine).

The Alizé is powered by a Rolls-Royce Dart RDa 7 turboprop engine. Its armament consists chiefly of bombs and rockets.

The first prototype of the Alizé flew on October 6, 1956, and five pre-production aircraft were being delivered in 1957. Orders for more than 100 production Alizés have been placed by the French Navy and these aircraft will be used on both light and fleet type aircraft carriers.

TYPE.—Three-seat Anti-submarine aircraft.

WINGS.—Cantilever low-wing monoplane, with hydraulically-folding outer panels. All-metal two-spar structure. Double-slotted flaps. Wing area 36 m.² (387.5 sq. ft.).

FUSELAGE. — All-metal semi-monocoque structure.

TAIL UNIT.—All-metal cantilever monoplane type.

LANDING GEAR.—Retractable tricycle type, the main wheels retracting forward into combined landing gear-armament nacelles on the wing leading edges. Hispano-Suiza double-chamber shock-absorbers. Twin wheels on main units. Steerable nose-wheel. Hydraulic brakes and landing gear retraction. Retractable arrester hook under rear fuselage.

POWER PLANT.—One 2,000 s.h.p. Rolls-Royce Dart R.Da.7 turboprop engine driving 3.53 m. (11 ft. 7 in.) diameter Rotol four-blade variable-pitch metal airscrew. Fuel tanks in wing centre-section and under cockpit.

ACCOMMODATION.—Enclosed cabin with side-by-side seats for pilot and forward radar operator at front and sideways-facing seat for rear operator behind on starboard side.

ARMAMENT.—Provision for bombs, depth charges, sono-buoys, rockets, etc., in fuselage bomb-bay, wing nacelles and under wings.

DIMENSIONS.—
Span 15.3 m. (50 ft. 2 in.).
Width folded 7 m. (22 ft. 11 in.).
Length 13.7 m. (45 ft.).
Height 5.18 m. (17 ft.).

WEIGHT.—
Weight loaded 8,000 kg. (17,640 lb.).

PERFORMANCE.—
Patrol speed range 220-330 km.h. (140-205 m.p.h.).
Endurance over 4 hr.
Max. range 2,500 km. (1,550 miles).

THE BREGUET TYPE 940.

The Type 940 will be the first of a series of designs incorporating what the company calls the "blown wing" principle. A prototype is under construction and a complete wing and power plant installation is being tested on a mobile ground rig.

Designed to carry 21 passengers or more than 2,720 kg. (6,000 lb.) of freight, it will have a high unbraced wing, the entire leading-edge of which will be in the slipstream of four large diameter airscrews, driven by 400 h.p. Turbomeca Turmo turboprop engines. The four airscrews will be linked by a transverse shaft so that engine failure will not stop any one airscrew. The wings will be provided with large double flaps.

DIMENSIONS.—
Span 17.50 m. (57 ft. 5 in.).
Length 12.00 m. (39 ft. 4 in.).

WEIGHT.—
Weight loaded 6,500 kg. (14,330 lb.).

PERFORMANCE (estimated).—
Max. cruising speed 380 km.h. (236 m.p.h.).
Landing speed 45 km.h. (28 m.p.h.).
Take-off run 60 m. (200 ft.).
Landing run 35 m. (115 ft.).

THE BREGUET TYPE 941

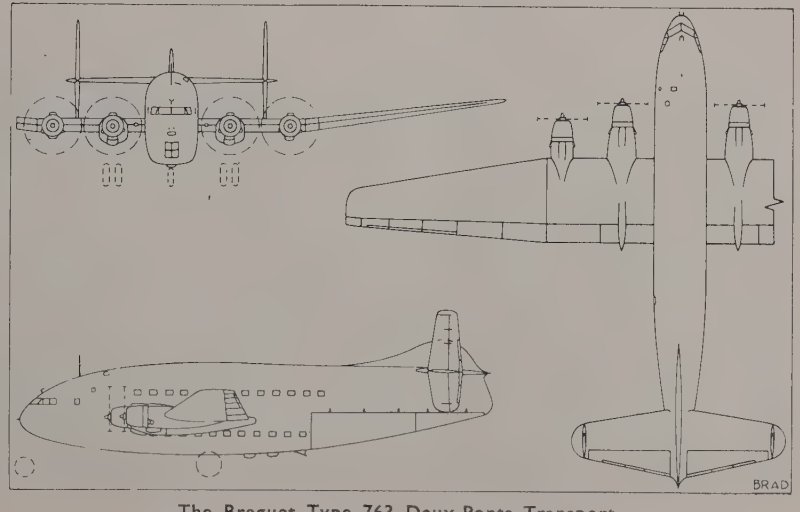
The Type 941 is a project for a military version of the Type 940 with four General Electric T58 turboprops. Its general layout will be similar to the civil model but provision is made for rear ramp loading. No other details are available.

THE BREGUET TYPE 763 DEUX-PONTS AND TYPE 765 SAHARA.

The Breguet 763 and 765 are the production developments of the Type 761, the design of which was begun in 1944. The prototype 761 fitted with four 1,600 h.p. Snecma 14R engines flew for the first time on February 15, 1949, and was awarded a certificate of airworthiness at an all-up weight of 40,000 kg. (88,000 lb.).

A pre-series of three aircraft, designated Type 761 S, was then put into production, the first making its first flight in 1951. These three aircraft are identical to the prototype except that they are powered with four 2,000 h.p. Pratt & Whitney R-2800 B31 engines driving Ratier reversible-pitch airscrews. This type was awarded a C. of A. at a gross weight of 45,000 kg. (99,000 lb.).

Type 763. First production version of "Deux Ponts." Twelve ordered by Air France in 1951. Four 2,400 h.p. Pratt & Whitney R-2800 CA18 engines driving Hamilton Standard reversing airscrews. The fuselage is generally the same as in Type 761, but span is increased and the wings reinforced. Furthermore the accommodations were completely redesigned to meet Air France's requirements for a convertible passenger/cargo aircraft, the standard version carrying 59 tourist passengers on the upper deck and 48 second-class passengers on the lower deck. The flight compartment was re-arranged to meet Air France's



The Breguet Type 763 Deux-Ponts Transport.



The Breguet Type 763 Deux-Ponts Transport (four 2,400 h.p. Pratt & Whitney R-2800-CA18 engines).

request for the reduction of the flight crew from four to three.

The Type 763 is used by Air France under the type name "Provence." The prototype made its maiden flight on July 20, 1951, and was awarded a C. of A. for a take-off weight of 48,000 kg. (105,600 lb.), since increased to 51,600 kg. (113,800 lb.).

Type 765 Sahara. Military transport version of "Deux Ponts." Fifteen ordered early in 1956 are likely to be cancelled under 1957 "cut-back" of military contracts. Fitted with four Pratt & Whitney R-2800-CB16 or CB-17 engines and military-style accommodations. To demonstrate the suitability of the "Deux Ponts" for military operations, the three Type 761S pre-production aircraft underwent military tests in the Autumn of 1954 in co-operation with Parachute Troop section of French Army. Programme included the dropping of a "stick" of 150 airborne troops, transporting a fully-equipped 105 mm. battery and a AMX medium tank. In supply-dropping tests, parachute supply units up to individual weights of 6,000 kg. (13,200 lb.) were dropped. On one occasion 14.5 tonnes (14,724 kg. = 34,029 lb.) were dropped in the space of 18 seconds. More recently the three 761's have been employed by the French Army on troop and equipment transport between metropolitan France and territories of the French Union.

The description which follows refers to the Type 765.

TYPE.—Four-engined Military Transport.

WINGS.—Cantilever mid-wing monoplane. Aspect ratio 9.95. Light alloy structure with stressed metal skin. Metal ailerons each in three sections on outer wings. Area (each) 9.2 m.² (99 sq. ft.). Breguet slotted flaps in four sections each side between ailerons and fuselage. Hydraulic actuation. Total flap area 27.51 m.² (296 sq. ft.). Gross wing area 185.4 m.² (1,996 sq. ft.).

FUSELAGE.—Two-deck monocoque in five main sections. Duralumin structure with stressed metal skin. Max. fuselage width 3.30 m. (10 ft. 9½ in.), max. depth 5.0 m. (16 ft. 5 in.).

TAIL UNIT.—All-metal cantilever structure consisting of tailplane mounted at top of fuselage with elevators on each side of central dorsal fin. Inset from tips of tailplane are the two-piece fins and rudders, latter with three trim and balance tabs each. Total horizontal area 41.90 m.² (449 sq. ft.). Total vertical area 21.98 m.² (236 sq. ft.). Dorsal fin area 7.12 m.² (76.8 sq. ft.).

LANDING GEAR.—Retractable tricycle type. Messier shock struts to all wheels. Twin main wheels, single nose-wheel, hydraulic retraction. Track 7.98 m. (26 ft. 2 in.).

POWER PLANT.—Four Pratt & Whitney R-2800 CB16 or CB17 eighteen-cylinder two-row radial air-cooled engines delivering 2,400 h.p. or 2,500 h.p. respectively at take-off with water injection. Hamilton Standard 43 E 60 three-blade constant-speed and reversing airscrews, 4.216 m. (13 ft. 8 in.) diameter. Total fuel capacity 15,300 litres (3,366 Imp. gallon); two 3,220 litre (708 Imp. gallon) tanks in outer wings; two 4,130 litre (908 Imp. gallon) tanks in centre-section and two 300 litres (66 Imp. gallon) reserve tanks one in each outer engine nacelle. Provision for two additional wing-tip tanks of 2,500 litres (550 Imp. gallon) each. Oil capacity 800 litres (173 Imp. gallons) in four tanks.

ACCOMMODATION.—Fuselage divided into two decks. Crew compartment in nose on upper deck with accommodation for five. Easily-convertible accommodation on two decks for up to 146 fully-equipped troops, or 85 litters and medical attendants, or freight, vehicles and equipment, including a 15-ton Army tank. Loading and unloading of freight hold through large rear panels beneath rear fuselage, operated by hydraulic jacks. Normal access for passengers through lateral doors in closed freight-loading panels aft and then by staircase to upper deck. A door on front starboard side for passengers or for loading small pieces of freight. Volume of lower deck 83.1 m.³ (2,934 cub. ft.). Lower deck floor 1.30 m. (4 ft.) from ground, permitting direct loading from trucks.

DIMENSIONS.—
Span 42.99 m. (140 ft. 5 in.).
Length 28.94 m. (94 ft. 11 in.).
Height 9.91 m. (32 ft. 7 in.).

WEIGHTS.—
Weight empty 31,000 kg. (68,343 lb.).
Crew (5) 400 kg. (880 lb.).
Fuel and oil 8,115-14,000 kg. (17,890-30,865 lb.).
Max. payload 13,000-17,000 kg. (28,660-37,480 lb.).
Max. take-off weight 54,000 kg. (119,050 lb.).
Max. landing weight 48,000 kg. (105,822 lb.).

PERFORMANCE.—
Max. cruising speed 380 km.h. (231 m.p.h.) at 3,050 m. (10,000 ft.).
Economic cruising speed 336 km.h. (210 m.p.h.) at 3,000 m. (9,840 ft.).
Rate of climb at S/L. 331 m./min. (1,080 ft./min.).
Rate of climb at 2,300 m. (5,000 ft.) 306 m./min. (1,000 ft./min.).
Rate of climb at S/L. (on 3 engines) 140 m./min. (460 ft./min.).
Climb to 3,000 m. (9,840 ft.) 19 min.
Take-off run to clear 15 m. (50 ft.) 1,550 m. (1,700 yds.).
Landing distance from 15 m. (50 ft.) 1,100 m. (1,200 yds.).
Max. range in still air (with 10% reserve of cruise fuel and allowance for 1 hour stacking and 300 km. diversion) at full



A Breguet Type 763 Deux-Ponts with freight loading in progress fore and aft.

load and using tip-tanks 4,000 km. (2,490 miles) at max. cruising speed, and 4,700 km. (2,930 miles) at most economical cruising speed.

THE BREGUET TYPE 901.

The Type 901 is a development of the Type 900, which was described in earlier editions of "All the World's Aircraft." It took first place in the 1954 World Championship contest for single-seat sailplanes and a production batch of 60 is now being built.

A new version known as the Type 901S, with modified flaps, larger tail unit and loaded weight of 415 kg. (915 lb.) won the single-seat class at the 1956 World Gliding Championships.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Shoulder-wing cantilever monoplane. NACA 63 Series laminar-flow wing section. Aspect ratio 20. Single spruce and plywood spar with leading-edge torsion box of plywood-klegecell sandwich. Slotted ailerons with 25° upward and 15° downward movement on outer halves of each half span. Slotted flaps inboard. Metal dive brakes on upper and lower surfaces. Gross wing area 15 m.² (161 sq. ft.).

FUSELAGE.—Wood structure with plywood skin. Fin integral with rear fuselage.

TAIL UNIT.—Cantilever monoplane type. Horizontal tail-surfaces can be folded. Total horizontal area 2.07 m.² (22.3 sq. ft.), total vertical area 1.02 m.² (11 sq. ft.).

LANDING GEAR.—Single retracting wheel with hydraulic brake. Local reinforcement of fuselage around wheel allows wheels-up landing without serious damage to structure, while drag saving due to removal of skid is substantial.

ACCOMMODATION.—Single cockpit with flush canopy. Radio, blind-flying equipment and oxygen are provided.

DIMENSIONS.—
Span 17.32 m. (56 ft. 10 in.).
Length 7.16 m. (23 ft. 4 in.).

WEIGHTS.—
Without water ballast 315 kg. (694 lb.).
With water ballast 390 kg. (860 lb.).

PERFORMANCE.—
Max. L/D. ratio 36.
Min. rate of sink 0.65 m./sec. (2.13 ft./sec.). at 72 km.h. (45 m.p.h.).
Max. speed at safe load 225 km.h. (140 m.p.h.).



The Breguet Type 901 High-performance Sailplane.

THE BREGUET TYPE 902.

First flown on May 14, 1957, the Type 902 is a tandem two-seat high-performance training glider of orthodox, but very simple, construction. It has a square-section fuselage and trapezoidal shoulder wings with wing-tip "salmons." No other details were available at the time of writing.

THE BREGUET TYPE 904.

The Breguet 904 is a two-seat version of the highly successful Type 901 single-seat sailplane. Two prototypes have been built, the first of which made its first flight on May 26, 1956 and a series of 15 production 904's is now being built.

The Type 904 has an NACA 63 series laminar flow-wing with an aspect ratio of 20 and with "salmons" on the tips.

DIMENSIONS.—
Span 20 m. (65 ft. 7 in.).
Length 9 m. (29 ft. 6 in.).
Height 2.5 m. (8 ft. 2½ in.).

WEIGHTS.—
Weight empty 350 kg. (772 lb.).
Weight loaded 630 kg. (1,389 lb.).

PERFORMANCE.—
Best glide ratio 37.
Min. rate of sink 0.65 m./sec. (2.13 ft./sec.) at 75 km.h. (46.6 m.p.h.).
Max. design speed 220 km.h. (137 m.p.h.).

BROCHET

AVIONS MAURICE BROCHET.

HEAD OFFICE AND WORKS: 12 RUE SAINT-MARTIN, NEAUPHLÉ-LE-CHATEAU (S.-ET-O.).

M. Maurice Brochet specialised originally in the design of light aircraft for the amateur constructor, and all his designs are conceived with the greatest simplicity.

Of recent Brochet aircraft, ten M.B. 70's, ten M.B. 80's, five M.B. 100's and fifteen M.B. 101's have been built for the S.F.A.S.A. (formerly S.A.L.S.) for distribution among French flying clubs.

The latest products of the company are the M.B. 120 two-seat light cabin monoplane and the M.B. 110 four-seat touring monoplane, the prototype of which flew for the first time on March 12, 1956.

THE BROCHET M.B. 70.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing braced monoplane. Two-spar wood structure covered with fabric. Vee bracing struts. Wing area 14 m.² (151 sq. ft.).

FUSELAGE.—Rectangular wood structure.

TAIL UNIT.—Cantilever monoplane type. Wood framework covered with fabric.

LANDING GEAR.—Fixed type. Two faired side Vees and two half axles, the latter hinged to a tubular Vee cabane beneath the fuselage. Rubber cord shock-absorbers. Lockheed wheel brakes. Solid rubber tail-wheel interconnected with rudder-bar.

POWER PLANT.—One 45 h.p. Salmson 9ADB nine-cylinder radial air-cooled engine. Two wing fuel tanks with a total capacity of 70 litres (15.5 gallons).

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Upward-opening door on each side.

DIMENSIONS.—
Span 10.35 m. (34 ft. 6 in.).
Length 6.50 m. (21 ft. 4 in.).

THE BROCHET M.B. 80.

The M.B. 80 is a development of the M.B. 70. The fuselage is 10.2 cm. (4 in.) wider, all control surfaces are balanced, the landing-gear is of the steel spring type as fitted to the M.B. 100 and the engine is a 75 h.p. Minié 4DC.32B flat-four.

A series of ten was ordered for the S.F.A.S.A.

THE BROCHET M.B. 100.

The M.B. 100 is a three-seat development of the M.B. 70. The cabin seats two side-by-side with dual controls in front, with the third seat centrally-placed behind.

The M.B. 100, which is not intended for the amateur constructor, has a steel tube fuselage and a Cessna-type spring steel cantilever landing-gear. It is powered with a 91 h.p. Hirth 504 four-cylinder in-line inverted air-cooled engine. The first production M.B. 100 flew on March 25, 1953.

DIMENSIONS.—
Span 10.66 m. (34 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
Height 2.0 m. (6 ft. 7 in.).
Wing area 14.23 m.² (153 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 465 kg. (1,023 lb.).
Weight loaded 780 kg. (1,716 lb.).
Wing loading 54 kg./m.² (11 lb./sq. ft.).
Power loading 8.66 kg./h.p. (18 lb./h.p.).

PERFORMANCE.—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 165 km.h. (102.4 m.p.h.).
Landing speed 55 km.h. (34 m.p.h.).
Rate of climb 180 m./min. (590 ft./min.).
Service ceiling 3,500 m. (11,480 ft.).
T.O. run 180 m. (196 yds.).
Landing run 160 m. (175 yds.).
Range 600 km. (375 miles).

THE BROCHET M.B. 101.

The M.B. 101 differs from the M.B. 100 by having an air filter and suitable external finish for service in North Africa. Fifteen have been built for use in schools in North Africa.

THE BROCHET M.B. 110.

Two prototypes of the M.B. 110 were ordered on October 23, 1954, at the instigation of the Service de la Formation Aéronautique et des Sports Aériens (S.F.A.S.A.). The specification called for a four-seat long-range touring aircraft, which had to be easy to build and simple to fly.



The Brochet M.B. 100 (91 h.p. Hirth 504 engine).

The first prototype M.B. 110 was completed on March 6, 1956, and made its first flight six days later.

TYPE.—Four-seat Touring monoplane.

WINGS.—High-wing braced monoplane. Göttingen 634 wing section. Aspect ratio 7.8. Chord 1.50 m. (4 ft. 11 in.) at root, 1.20 m. (3 ft. 11 in.) at tips. Dihedral 1°. Incidence 2° at root, nil at tips. All-wood two-spar structure with plywood covering. Wing braced by steel-tube streamlined V-struts on each side. Wooden mass-balanced ailerons with fabric covering. Manually-operated three-position slotted flaps of all-wood construction. Wing area 15.65 m.² (168.5 sq. ft.).

FUSELAGE.—Steel-tube structure, with plywood-covered rear decking and fabric covering overall.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Fin has plywood-covered leading-edge and fabric covering aft of spar. Tailplane is plywood-covered. Rudder and elevators are fabric-covered. Controllable trim-tabs in rudder and both elevators.

LANDING GEAR.—Fixed tail-wheel type. Adjustable metal spring shock-absorbers. Low-pressure tyres. Hydraulic brakes. Tailwheel is arranged to turn either in conjunction with the rudder or through a separate pilot-operated control. Track 2.20 m. (7 ft. 3 in.). Wheelbase 4.25 m. (13 ft. 11 in.).

POWER PLANT.—One 170 h.p. SNECMA-Régnier 4LO2 four-cylinder in-line inverted air-cooled engine, driving a two-blade Ratier-Figeac fixed-pitch metal airscrew. Fuel in four wing tanks.

ACCOMMODATION.—Enclosed cabin seating four, with two bucket-type front seats and rear bench-type seat. Dual controls. Door on each side of cabin with sliding window. Backs of front seats tip forward to give access to rear of cabin. Baggage compartment behind rear seat.



The Brochet M.B. 120 (90 h.p. Continental C90 engine).

DIMENSIONS.
Span 11.06 m. (36 ft. 4 in.).
Length 7.68 m. (25 ft. 2½ in.).
Height 2.56 m. (8 ft. 5 in.).

WEIGHTS AND LOADING.—
Weight empty 800 kg. (1,764 lb.).
Weight loaded 1,300 kg. (2,866 lb.).
Wing loading 83.30 kg./m.² (17.06 lb./sq. ft.).

PERFORMANCE.—
Max. speed 240 km.h. (149 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Take-off run 220 m. (720 ft.).
Landing run 250 m. (820 ft.).
Normal range 1,000 km. (620 miles).

THE BROCHET M.B. 120.

The M.B. 120 is a two-seat light touring monoplane, the prototype of which flew for the first time on April 5, 1954. It has the airframe of the M.B. 100 remodelled as a two-seater, to which have been fitted the lighter wings, with landing-flaps, of the M.B. 80. The M.B. 120 is powered by a 90 h.p. Continental C90 flat-four engine.

DIMENSIONS.—
Span 10.66 m. (34 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
Height 2.0 m. (6 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 505 kg. (1,111 lb.).
Weight loaded 765 kg. (1,683 lb.).
Wing loading 52 kg./m.² (10.66 lb./sq. ft.).
Power loading 8.5 kg./h.p. (18.7 lb./h.p.).

PERFORMANCE.—
Max. speed 195 km.h. (121 m.p.h.).
Cruising speed 170 km.h. (105.5 m.p.h.).
Service ceiling 5,000 m. (16,400 ft.).
Take-off run 200 m. (218 yds.).
Landing run 180 m. (196 yds.).
Range 800 km. (500 miles).

C.A.B.

CONSTRUCTIONS AÉRONAUTIQUES DU BÉARN (C.A.B.).

HEAD OFFICE: 32, AVENUE BIÉ-MOULIÉ, PAU (BASSES-PYRÉNÉES).

WORKS: PAU-IDRON AIRPORT, PAU (BASSES-PYRÉNÉES).

This concern builds the Minicab two-seat light monoplane, of which a series of ten was built for the Service de la Formation Aéronautique et de Sports Aériens (formerly S.A.L.S.) and others have been sold privately. Two versions, designated GY-20 and GY-201, differed only in equipment.

A development of the Minicab, known as the Supercab, was fitted with a retractable landing gear and powered with a 90 h.p. Continental engine. Six were built, two for the S.F.A.S.A.

Both the Minicab and Supercab have been described and illustrated in previous editions of this Annual.

DASSAULT

GENERALE AERONAUTIQUE MARCEL DASSAULT.

HEAD OFFICE: 78, QUAI CARNOT, SAINT-CLOUD (SEINE-ET-OISE).

WORKS: SAINT CLOUD (SEINE-ET-OISE), ARGENTEUIL (SEINE-ET-OISE), BOULOGNE (SEINE), MERIGNAC (GIRONDE) AND TALENCE (GIRONDE).

Director-General: M. B. C. Vallières.
Technical Director: M. Henri Deplante.
Production Director: M. M. Guibert.

Générale Aéronautique Marcel Dassault, formerly the Société des Avions Marcel Dassault, is engaged in the development and production of military aircraft.

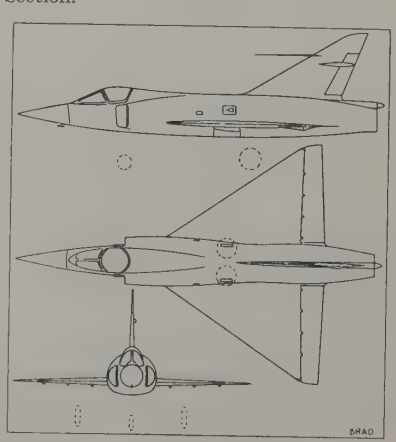
The Company's principal current productions are the Mystère IV A and the Super Mystère B2. Under development are the Etendard IV and VI swept-wing and the Mirage I and III delta-wing fighters, brief details of all of which appear below.

The M.D. 450 Ouragan was in production from 1951 to 1953. 350 were supplied to the French Air Force and more than 100 to the Indian Air Force. The Mystère II was produced in quantity (150) for the French Air Force, and this was followed by the Mystère IV A, which was also the subject of a large "off shore" order placed by the U.S. Government under the N.A.T.O. joint aircraft programme. The IV A was also ordered in quantity by the Indian Government, and the first deliveries of an order of 125 for the Indian Air Force began in March, 1957.

Series production is undertaken under a widespread sub-contracting programme, with the final assembly and flight testing being handled by Dassault. The total employment of the Dassault factories is only 5,000 while some 30,000 employees of other concerns all over France are engaged in the production of Dassault parts and sub-assemblies.

Dassault is also engaged in the development and manufacture of equipment, mainly powered aircraft controls with "feel" simulation. An electronic department is engaged in studying radar problems.

In 1953 Dassault acquired the manufacturing licence of the Viper turbojet engine from Armstrong Siddeley Motors Ltd. For details of the Dassault M.D.30 Viper see under "Dassault" in the Engine Section.



The Dassault Mirage III.

THE DASSAULT MIRAGE I.

The Mirage I, which made its maiden flight (on jet-power only) on June 25, 1955, is a twin-engined delta-wing fighter which was designed to conform to a French Air Ministry specification for a light fighter. It is powered by two Dassault M.D. 30 Viper (Armstrong Siddeley licence) turbojet engines with afterburners, and an SEPR rocket motor (1,500 kg. = 3,300 lb. s.t.) burning a self-igniting mixture of furaline and nitric acid.

The Mirage I flew for the first time with its SEPR rocket in operation on December 17, 1956.

No other details were available for publication at the time of closing for press.

THE DASSAULT MIRAGE III.

The Mirage III is a delta-wing supersonic aircraft which from the outset was planned with the equipment and armament necessary for fulfilling the duties of high altitude interception, fighting and tactical support. It is powered by a SNECMA Atar 101 G engine with afterburner and will also be fitted in due course with one SEPR rocket motor (3,000 kg. = 6,610 lb. s.t.).

To enable it to undertake the above-mentioned missions the Mirage III is fitted with long-range detection and missile-firing radar equipment; has two rapidly-removable 30 mm. cannons in the fuselage; and is provided with three under-wing adaptors to which additional military loads such as bombs, rockets, napalm tanks or auxiliary fuel tanks may be attached. Internal fuel capacity is 2,600 litres (572 Imp. gallons).

The Mirage III, with its light structure weight and low-pressure wide tread tyres,



The Dassault Mirage III (SNECMA Atar turbojet engine and SEPR rocket motor).

has the advantage of being able to operate from short or makeshift runways. Due to its simplicity, maintenance may be undertaken in the field.

To increase its versatility, the possibility of launching the Mirage III from a ramp, identical to that used for the U.S. Martin Matador missile, is being studied. Additional thrust would be provided by two jettisonable assisted take-off rockets developing a total of 13,000 kg. (28,660 lb.) s.t. for 2½ seconds, which would produce a 4g acceleration.

The Mirage III prototype flew for the first time on November 18, 1956. On January 30, 1957, in the course of normal testing, it exceeded Mach 1.5 in level flight at an altitude of 11,000 m. (36,080 ft.) without rocket. This is the equivalent of approximately 1,600 km.h. (1,000 m.p.h.).

A pre-series of ten Mirage III interceptors is under construction. These aircraft have a more powerful Atar turbojet and SEPR rocket motor.

DIMENSIONS.—
Span 7.58 m. (24 ft. 11 in.).
Length 12.65 m. (41 ft. 6 in.).
Height 4.68 m. (15 ft. 4 in.).

WEIGHTS AND LOADINGS (approx.).—
Weight empty 3,500 kg. (7,715 lb.).
Weight loaded 5,000 kg. (11,025 lb.).
Wing loading 175 kg./m.² (35.84 lb./sq. ft.).
Power loading 0.85 kg./kg. s.t. (0.85 lb./lb. s.t.).

PERFORMANCE (approx.).—
Max. speed Mach 1.6.
Ceiling 17,000 m. (55,750 ft.).
Range 1,000 km. (620 miles).

THE DASSAULT ETENDARD VI.

The Etendard VI is a single-engined unpressurised swept-wing lightweight fighter which conforms to a N.A.T.O. specification for a tactical support fighter.

It has a 45° swept wing, with an anhedral of 2° 30′ and thickness/chord ratio of 6%. Internal fuel tankage comprises 2,150 litres (473 Imp. gallons) in the fuselage and 600 litres (132 Imp. gallons) in the wings. All controls are powered, and a spring "feel" unit is fitted to the one-piece tailplane. The wheels are equipped with low-pressure tyres for operation from unprepared airfields.

Fixed armament is four 0.5 in. machine-guns. In addition, there are two underwing pylons, each of which can carry a canister of nineteen 68 mm. rockets, or up to six 60-lb. rockets, or one 1,000 lb. bomb, or a 650-litre (143 Imp. gallon) napalm tank, or a 425-litre (93.4 Imp. gallon) fuel tank.

Three prototypes, to be powered by the Bristol Orpheus turbojet engine, have been ordered by N.A.T.O. The maiden flight of the Etendard VI, powered by an Orpheus BOr.3 (2,200 kg.=4,850 lb. s.t.), took place on March 15, 1957.

No further details were available for publication at the time of closing for press.

THE DASSAULT ETENDARD IV.

The Etendard IV is a single-jet pressurised interceptor and ground support aircraft which is powered by a SNECMA Atar 101-E-4 turbojet engine (3,700 kg.= 8,160 lb. s.t.). It has the same general airframe specification and armament as the Etendard VI, but carries a pack of two 30 mm. DEFA cannon or 32 2.75 in. rockets in its fuselage in place of the machine-guns of the VI. The prototype made its first flight on July 24, 1956, and was built to a French Air Force requirement. A naval version designated the Etendard IVM is under development.

DIMENSIONS.—
Span 9.60 m. (31 ft. 6 in.).
Length 14.40 m. (47 ft. 2½ in.).
Height 4.30 m. (14 ft. 1 in.).

WEIGHTS AND LOADINGS (approx.).—
Weight empty 3,400 kg. (7,495 lb.).
Weight loaded 6,500 kg. (14,330 lb.).
Wing loading 217 kg./m.² (44.44 lb./sq. ft.).
Power loading 1.75 kg./kg. s.t. (1.75 lb./lb. s.t.).

PERFORMANCE (approx.).—
Max. speed Mach 1.0.
Ceiling 15,500 m. (50,850 ft.).
Range 1,200 km. (750 miles).

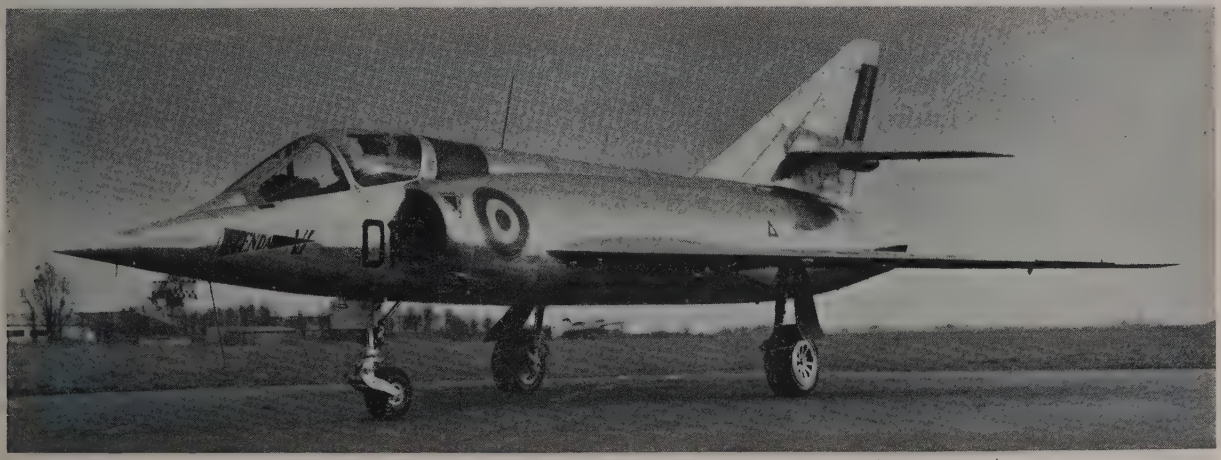
THE DASSAULT SUPER-MYSTÈRE.

The Super-Mystère is similar in general design to the Mystère IV B but has a thinner more sharply swept wing, an improved air inlet and better cockpit visibility.

The prototype Super-Mystère B-1, fitted with a Rolls-Royce Avon RA.7 engine with afterburner, first flew on March 2, 1955, and was flown at Mach 1 in level flight on its fourth flight on the following day.

A production order has been placed by the French Government for 370 Super Mystère B-2's, this version being powered by a SNECMA Atar 101G engine (4,500 kg.=9,900 lb. s.t.) with afterburner. Armament consists of 2×30 mm. DEFA cannon, plus 35 Matra folding-tail rockets in a retractable tray under the fuselage.

The first pre-production Super-Mystère B-2 flew on May 15, 1956, exceeding Mach 1 on its first flight, without using the afterburner with which it is fitted. The first production Super Mystère B-2



The Dassault Etendard VI Lightweight Fighter (Bristol Orpheus turbojet engine).



The Dassault Etendard IV Ground Support Monoplane (SNECMA Atar 101E turbojet engine).

made its maiden flight on February 26, 1957.

WEIGHTS.—
Normal weight loaded 9,000 kg. (19,840 lb.).
Max. weight loaded 11,000 kg. (24,250 lb.).

PERFORMANCE (at 9,000 kg. = 19,840 lb. A.U.W.).—
Max. speed 1,200 km.h. (745 m.p.h.).
Cruising speed 1,000 km.h. (620 m.p.h.).
Rate of climb 4,785 m./min. (15,700 ft./min.).
Ceiling 16,900 m. (55,500 ft.).
Endurance 1 hour.

THE DASSAULT MYSTÈRE IV A.

Although generally similar in general outline to the Mystère II, the IV A is a completely new aircraft. Its principal characteristics are given in the specification below.

An "off-shore" order for 225 Mystère IV A's was placed by the U.S.A.F., followed by an order of 100 for the French Air Force. In addition, 24 were ordered by Israel and 125 by the Indian Government.

The first IV A prototype flew on September 28, 1952, and the first production aircraft was delivered in June, 1954.

TYPE.—Single-seat Interceptor or Ground Attack Fighter.

WINGS.—Low-wing cantilever monoplane. Symmetrical laminar-flow wing section. Thickness/chord ratio 7.5%. Sweepback 40° 57′ at leading-edge, 38° at 25% of chord. Dihedral — 1° 30′. All-metal structure. Split flaps between ailerons and fuselage. Gross wing area 32 m.² (344.3 sq. ft.).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. Generally similar to that of Mystère II except rudder is in one piece and above horizontal surface only. All-flying tail with hydraulic servo-controls.

LANDING GEAR.—Messier hydraulically-operated retractable nose-wheel type. Track 3.25 m. (10 ft. 8 in.).

POWER PLANT.—One Hispano-Suiza Verdon centrifugal-flow turbojet engine (3,500 kg. = 7,000 lb. s.t.). Main fuel in wings and fuselage. Auxiliary fuel in two external tanks carried beneath wings inboard of armament attachments on Alkan explosive releases. Total internal fuel 2,600 litres (572 Imp. gallons), total external fuel 1,250 litres (275 Imp. gallons).

ACCOMMODATION.—Pressurised cockpit with electrically operated sliding canopy. Ouest-Aviation ejector seat.

ARMAMENT.—Two 30 mm. cannon (150 r.p.g. each) in lower forward fuselage. Matra automatic rocket magazine containing 55 air-to-air rockets in fuselage aft of cannon installation. Attachment points under wings, with Alkan explosive releases, for two 227 kg. (500 lb.) or 454 kg. (1,000 lb.) bombs, or two 480-litre (106 Imp. gallon) Napalm containers, or two Matra rocket containers (19 air-to-air rockets each), or two groups of six air-to-ground rocket projectiles.

DIMENSIONS.—
Span 11.12 m. (36 ft. 5½ in.).
Length 12.85 m. (42 ft. 1½ in.).
Height 4.40 m. (14 ft. 5 in.).

WEIGHTS.—
Weight empty 5,680 kg. (12,496 lb.).
Weight loaded 7,500 kg. (16,535 lb.).

PERFORMANCE.—
Max. speed at S/L. 1,120 km.h. (695 m.p.h.).
Max. speed at operational altitude 990 km.h. (615 m.p.h.).

THE DASSAULT MYSTÈRE IV B.

The Mystère IV B differs from the IV A in the design of the front and rear fuselage and in power-plant. In the IV B the air inlet duct goes under the pilot's cockpit instead of dividing to pass on either side. Because of the re-alignment of the nose air inlet duct, the nose-wheel unit now retracts backwards, with the wheel turning through 90 degrees to lie flat beneath the air duct when fully retracted. The nose inlet aperture is similar to that of the North American F-86 Sabre with upper lip containing radar telemeter. The rear fuselage is longer to accommodate an afterburner.

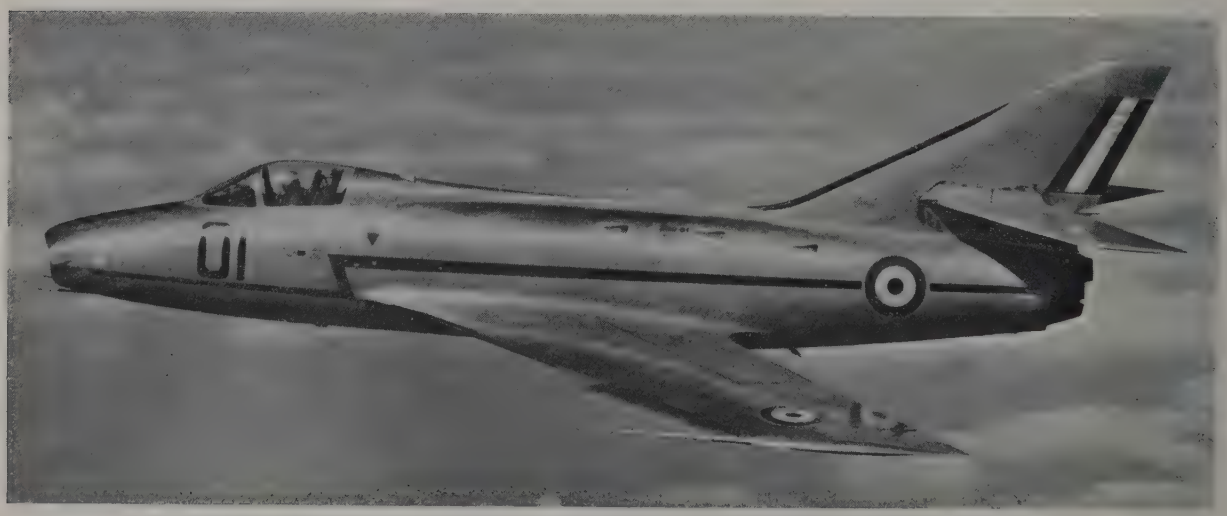
The prototype IV B, powered by a Rolls-Royce Avon RA.7R with afterburner, first flew on December 16, 1953, and on February 24, 1954, this aircraft exceeded Mach 1 in level flight. During 1956 it completed a series of flight tests with an SEPR rocket motor installed under the fuselage, as part of the development programme for the Mirage interceptor.

DIMENSIONS.—
Same as for Mystère IV A except:
Length 13.40 m. (43 ft. 11½ in.).

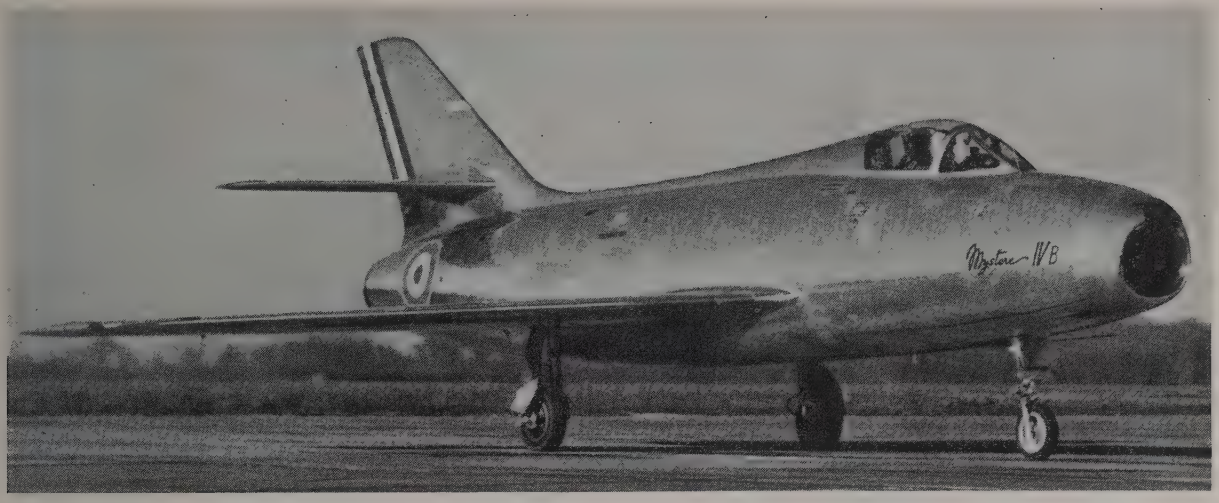
WEIGHTS AND PERFORMANCE.—
No data available.

THE DASSAULT M.D. 452 MYSTÈRE II.

The M.D. 452 is a swept-wing version of the M.D. 450. The first of three Mystère I prototypes, powered with an Hispano-Suiza Nene engine, made its first flight on February 23, 1951. The other two Mystère I prototypes, the first of which flew on April 5, 1952, were powered by Hispano-Suiza Tay engines.



The Dassault Super-Mystère B-2 (SNECMA Atar 101G turbojet engine).



The Dassault Mystère IV B Interceptor Fighter (Rolls-Royce Avon turbojet engine).

A pre-production series of seventeen Mystère II's was ordered in April, 1951. The first two were Mystère II A's with Hispano-Suiza Tay 250 engines; the next three were Mystère II B's with Tay 250 engines but with the armament changed from four 20 mm. to two 30 mm. cannon; while the last twelve were Mystère II C's with various versions of the SNECMA Atar 101 engine. The last two II C's were fitted with Atar 101F engines with afterburning.

The third pre-series Mystère II powered by an Hispano-Suiza Tay engine and fully armed with four 20 mm. cannon, exceeded Mach 1 on October 28, 1952, the first French aircraft to do so.

In April, 1953 the French Government placed a production order for 150 Mystère II C's to be powered by the SNECMA Atar 101D engine. The first production IIC flew in June, 1954, and production has now been completed.

The following description refers to the Mystère II C.

TYPE.—Single-seat Interceptor Fighter.

WINGS.—Low-wing cantilever monoplane. Symmetrical laminar-flow wing section. Thickness/chord ratio 9°. Sweepback 30° at 25% chord, 33° at leading-edge. Incidence at root 1°, at tip — 0° 34′. Dihedral 1° 30′. Two-spar all-metal structure. Split flaps between ailerons and fuselage. Gross wing area 30.3 m.² (326 sq. ft.).

FUSELAGE.—Circular-section all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Fin sweepback 44° at 25% of chord. Rudder in two sections divided by horizontal surfaces. Tailplane has 5° dihedral at 32° sweepback at 25% of chord. Tailplane incidence adjustable from + 1° 40′ to — 2° 50′. Span of tail 3.84 m. (12 ft. 6 in.).

LANDING GEAR.—Messier hydraulically-operated retractable nose-wheel type. Main wheels raised inward, nose-wheel forward. Wheelbase 3.93 m. (12 ft. 10 in.). Track 2.20 m. (7 ft. 2⅛ in.).

POWER PLANT.—One SNECMA Atar 101 D2 axial-flow turbojet engine (3,000 kg. = 6,600 lb. s.t.). Nose air entry. Adjustable jet exit. Fuel in fuselage and wings outboard of landing-gear, plus pylon-mounted tanks.

ACCOMMODATION.—Pressurised cockpit with armoured windscreen and sliding jettisonable canopy. Sud-Aviation ejector-seat.

ARMAMENT.—Two 30 mm. cannon in fuselage (150 r.p.g. each). Gyro gun-sight. Radar range-finding equipment. Camera recorder and ciné-gun.

DIMENSIONS.—
Span (clean) 11.62 m. (38 ft. 1 in.).
Span (over tip-tanks) 13.05 m. (42 ft. 9 in.).
Length 11.74 m. (38 ft. 6 in.).
Height 4.26 m. (13 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 5,225 kg. (11,495 lb.).
Weight loaded 7,460 kg. (16,412 lb.).
Wing loading 246 kg./m.² (50.4 lb./sq. ft.).

PERFORMANCE.—
Max. speed at S/L. 1,060 km.h. (658 m.p.h.).
Max. speed at 12,000 m. (39,360 ft.) 935 km.h. (581 m.p.h.).
Landing speed 205 km.h. (127 m.p.h.).
Initial rate of climb 2,220 m./min. (7,280 ft./min.).
Rate of climb at 12,000 m. (39,360 ft.) 660 m./min. (2,164 ft./min.).
Endurance 1.3 hours.
Take-off distance to clear 15 m. (50 ft.) 1,300 m. (1,420 yds.).
Landing distance from 15 m. (50 ft.) 1,250 m. (1,370 yds.).

THE DASSAULT M.D. 450 OURAGAN (HURRICANE).

The M.D. 450 was the first French jet-propelled fighter to be ordered in quantity by the French Air Force and its evolution established a notable record in speed of design and construction. The design, to an official interceptor fighter specification, was begun in December, 1947, the official order for three prototypes was given on July 1, 1948, and the first prototype flew for the first time on February 28, 1949.

After very successful tests a pre-production order for twenty-five was placed and the first aircraft of this series flew at the end of November, 1950. The first production Ouragan flew for the first time in December, 1951.

Subsequently a total of 350 Ouragans was built for the French Air Force, and over 100 have been supplied to the Indian Air Force.

A full descriptive specification of the M.D. 450 has appeared in previous editions of this Annual.

THE DASSAULT BAROUGAN.

Barougan is the name which has been given to Ouragans of the French Air Force which have been modified to widen their operational usefulness. They have been fitted with twin main landing-gear wheels to permit their use from unprepared grass landing strips, and other less obvious modifications have been incorporated.



The Dassault M.D. 452 Mystère II Swept-wing Fighter (Hispano-Suiza Tay turbojet engine).

DRUINE

AVIONS ROGER DRUINE.

ADDRESS : 20, AVENUE DU GÉNÉRAL CLAVERY, PARIS (16e).

M. Roger Druine, who designed, built and flew his first aircraft at the age of seventeen, specialises in the design of aircraft which are suitable for amateur construction. His two most popular products are the Turbulent single-seat monoplane and the Turbi, a two-seat version of the Turbulent.

Both the Turbulent and Turbi are available in constructional kit form.

In the United Kingdom the Popular Flying Association, which has been delegated by the A.R.B. to administer the new simplified procedure for the classification of ultra-light aircraft, has acquired the rights for both the Turbulent and Turbi, and is marketing sets of plans and instructions for amateur construction.



The Druine D.31 Turbulent (28 h.p. modified Volkswagen engine).

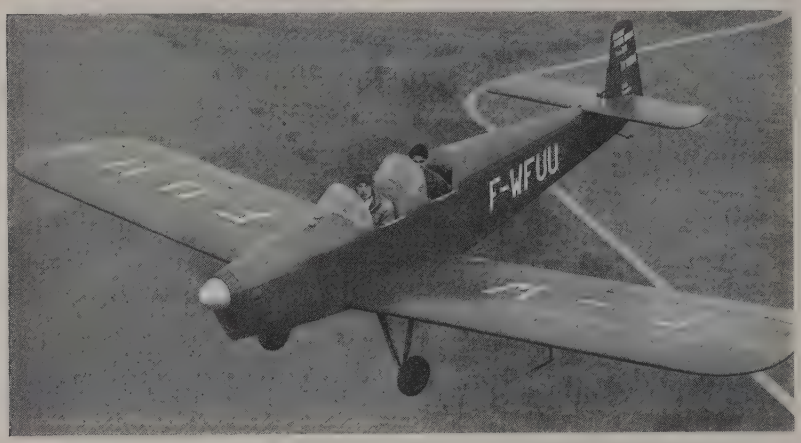
THE DRUINE D.31 TURBULENT.

The Turbulent is a conventional low-wing cantilever monoplane of wood and fabric construction which was designed primarily for the amateur constructor. It has met with considerable success and many have been built by clubs and private individuals.

PERFORMANCE.—
Max. speed at S/L. 140 km.h. (87 m.p.h.).
Cruising speed 120 km.h. (74.5 m.p.h.).
Landing speed 45 km.h. (28 m.p.h.).
Initial rate of climb 150 m./min. (492 ft./min.).
Climb to 1,000 m. (3,280 ft.) 9 min.
Endurance 2.5 hours.
Take-off run 160 m. (145 yds.).

THE DRUINE D.5 TURBI.

The Turbi is a two-seat development of the Turbulent. The prototype was designed for and fitted with the 45 h.p. Beaussier engine which is largely built up of components of the 11 h.p. Citroën automobile engine. More recently the design has been adapted to take the 65 h.p. Continental A65 flat-four or Walter Mikron four-cylinder inverted engines, and at least one British-built version has a Coventry Victor Flying Neptune engine.



The Druine D.5 Turbi Two-seater (45 h.p. Beaussier engine).

TYPE.—Single-seat light monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 23.012 wing section. Aspect ratio 5.4. Chord 1.20 m. (3 ft. 11 in.). Dihedral 4°. Incidence 3° 30'. Two-spar wood structure. D-type plywood leading-edge. Fabric covering aft of front spar. Built-in leading-edge slot on outer 45% of half span. Slotted ailerons have wood frames and fabric covering. Aileron area (total) 0.86 m.² (9.25 sq. ft.). Gross wing area 7.50 m.² (80.70 sq. ft.).

FUSELAGE.—Rectangular four-longeron structure with domed deck. Deck and sides covered with fabric, bottom with plywood.

TAIL UNIT.—Cantilever monoplane type. All-wood frames. Fin and tailplane covered with plywood, elevators and rudder with fabric. Areas : fin 0.12 m.² (1.29 sq. ft.), rudder 0.38 m.² (4.08 sq. ft.), tailplane 0.55 m.² (5.91 sq. ft.), elevators 0.50 m.² (5.38 sq. ft.). Span of tail 2.0 m. (6 ft. 7 in.).

LANDING GEAR.—Fixed divided type. Rubber-in-compression springing. Mechanical motorcycle type brakes. Small orientable tail-wheel. Track 1.25 m. (4 ft. 1 in.).

POWER PLANT.—One 28 h.p. modified Volkswagen or Porsche flat-four air-cooled engine. Two-blade fixed-pitch wood airscrew. One fuel tank (40 litres = 8.8 Imp. gallons) in fuselage in front of cockpit.

ACCOMMODATION.—Single open cockpit over trailing-edge of wing. Transparent canopy optional. Space for 11.3 kg. (25 lb.) baggage behind seat.

DIMENSIONS.—
Span 6.55 m. (21 ft. 5 in.).
Length 5.30 m. (17 ft. 4½ in.).
Height 1.52 m. (4 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 155 kg. (341 lb.).
Weight loaded 278 kg. (606 lb.).
Wing loading 38.2 kg./m.² (7.82 lb./sq. ft.).
Power loading 9.9 kg./h.p. (21.5 lb./h.p.).

TYPE.—Two-seat light monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section. Structure as for Turbulent. Gross wing area 12.9 m.² (139 sq. ft.).

FUSELAGE.—Rectangular four-longeron all-wood structure. Rear decking covered with fabric.

TAIL UNIT.—Cantilever monoplane type. Fin built integral with fuselage. Non-adjustable tailplane. Fixed surfaces plywood-covered, movable surfaces fabric-covered.

LANDING GEAR.—Fixed tail-wheel type. Spring shock-absorbers. Tail-skid.

POWER PLANT.—One 45 h.p. Beaussier 4 B02 four-cylinder inverted air-cooled engine. Merville two-blade fixed-pitch airscrew. Alternative power-plants may be the 65 h.p. Continental A65 or Walter Mikron or 55 h.p. Coventry Victor Flying Neptune engines. Fuel tank in fuselage decking in front of front cockpit.

ACCOMMODATION.—Tandem open cockpits.

DIMENSIONS.—
Span 8.70 m. (28 ft. 6 in.).
Length 6.86 m. (22 ft. 6 in.).
Wing area 13.50 m.² (145.2 sq. ft.).

WEIGHTS.—
Weight empty 280 kg. (610 lb.).
Weight loaded 495 kg. (1,090 lb.).

PERFORMANCE.—
Max. speed 155 km.h. (96 m.p.h.).
Cruising speed 120 km.h. (74.5 m.p.h.).
Landing speed 55 km.h. (34 m.p.h.).
Initial rate of climb 150 m./min. (492 ft. min.).
Range 640 km. (400 miles).
Take-off run 160 m. (175 yds.).

THE DRUINE CONDOR.

The Condor has been designed primarily for factory production and incorporates many refinements in design and construction not found in the previously described Turbulent and Turbi. A simplified version will however be made available for amateur construction.

The Condor is or will be available in the following versions :—

D.60. Prototype only. Fitted with 60 h.p. C.N.A. D4 (Italian) flat-four engine.

D.61. First production version. Powered by 65 h.p. Continental A65 flat-four engine.

D.62. Same as D.61 but fitted with 90 h.p. Continental C90 engine.

D.610. Similar to D.61 but modified to make it suitable for amateur construction.

D.620. Similar to D.62 but fitted with trailing-edge flaps and VHF radio.



The Druine D.61 Condor (65 h.p. Continental A65 engine).

TYPE.—Two-seat light monoplane.
WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.8. Incidence 5° at root, 3° at tip. Dihedral (upper surface) 4° 30'. Wood structure with one main spar at 30% of chord and one auxiliary spar. Leading edge covered with plywood, remainder with fabric, with a final overall protective covering of fabric. Slotted differentially-controlled ailerons. Trailing-edge flaps on D.620. Total area of ailerons 1.12 m.² (12.0 sq. ft.). Gross wing area 12.50 m.² (134.5 sq. ft.).
FUSELAGE.—All-wood structure with plywood skin and overall protective covering of fabric.
TAIL UNIT.—Cantilever monoplane type. Single-piece tailplane plywood-covered, with overall covering of fabric. Fin of similar construction is integral with fuselage. Wood-framed fabric-covered rudder and elevators. Areas: fin 0.32 m.² (3.4 sq. ft.), rudder 0.50 m.² (5.38 sq. ft.), tailplane 1.34 m.² (14.4 sq. ft.), elevators 0.72 m.² (7.74 sq. ft.). Span of tail 2.80 m. (9 ft. 2 in.).
LANDING GEAR.—Fixed tail-wheel type Cantilever shock struts with rubber-in-compression springing. Mechanical wheel-brakes. Tail-wheel with steel spring suspension and rubber cord self centering. Track 1.75 m. (5 ft. 9 in.).
POWER PLANT.—One 60 h.p. C.N.A. D4 (D.60 prototype) or one 65 h.p. (D.61) or 90 h.p. (D.62) Continental four-cylinder horizontally-opposed air-cooled engine. Fuel tank in fuselage behind fireproof bulkhead.
ACCOMMODATION.—Enclosed cockpit seating two side-by-side. Cabin superstructure of steel tube with single-piece windscreen and Plexiglas windows in doors, which are hinged to open upwards. Two large Plexiglas panels in cabin rear fairing. Baggage space behind seats.
DIMENSIONS.—
Span 9.20 m. (30 ft. 2 in.).
Length 6.55 m. (21 ft. 6 in.).
Height (tail down) 1.54 m. (5 ft.).
WEIGHTS AND LOADINGS (D.61).—
Weight empty 301.5 kg. (663 lb.).
Pilot and passenger 155 kg. (341 lb.).
Fuel and oil 43.5 kg. (96 lb.).
Weight loaded 500 kg. (1,100 lb.).
Wing loading 40 kg./m.² (8.2 lb./sq. ft.).
Power loading 7.6 kg./m.² (16.5 lb./h.p.).
PERFORMANCE (D.61—65 h.p. Continental).—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Ceiling 4,200 m. (13,780 ft.).
Range 650 km. (400 miles).
PERFORMANCE (D.62—90 h.p. Continental).—
Max. speed 220 km.h. (136 m.p.h.).
Cruising speed 195-200 km.h. (121-124 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Ceiling 5,600 m. (18,370 ft.).
Range 700 km. (435 miles).

FARMAN

SOCIÉTÉ ANONYME DES USINES FARMAN.

HEAD OFFICE: 149, RUE DE SILLY, BOULOGNE-BILLANCOURT (SEINE).

WORKS: 168, RUE DE BILLANCOURT AND 10, RUE PAUL-BERT, BOULOGNE-BILLANCOURT (SEINE).

AERODROME: TOUSSUS - LE - NOBLE, NEAR VERSAILLES (SEINE-ET-OISE).

President-Director General: Maurice Farman.

The original Farman company was formed by Henri Farman, one of the pioneers of French aviation, in 1908. Maurice Farman opened a works a little later. In 1912 the two brothers combined to form the company Avions H. et M. Farman.

When, in 1936, the Popular Front Government introduced the Law for the Nationalisation of Military Industries all of Farman's military aircraft design and production activities were incorporated into the Société Nationale de Constructions Aéronautiques du Centre, leaving only a comparatively small proportion of the company's affairs under private control. It is from this remnant of the original company that the present concern is derived.

In 1939 Farman acquired a licence to build the Stampe S.V.4 trainer and large orders for this aircraft were placed with the company by the French Government. Only a few were completed before the fall of France. After the war the S.V.4 manufacturing rights were transferred to the Société Nationale de Constructions Aéronautiques du Nord but Farman retained the licence.

The Société Farman, with the collaboration of M. Stampe, has developed a two-seat monoplane trainer, known as the Monitor, which incorporates many of the components of the S.V.4, including the fuselage and tail-unit.



The Farman Monitor III (170 h.p. SNECMA Régnier 4 L02 engine).

The original version, designated Monitor I, first flew on July 11, 1952, and has been followed by variants with different power-plants. The latest of these, the Monitor IV, has been taken over by M. Stampe's own company, Stampe et Renard S.A. in Belgium, and a full description of it is given under the entry for that company.

Farman also undertakes the repair, maintenance and hangarage of aircraft at its airfield at Toussus-le-Noble, where its hangar of 6,000 m.² (64,585 sq. ft.) floor area is large enough to accommodate any aircraft yet built.

In its other factory at Billancourt, Farman produces tools and equipment for the major types of aircraft in service with the French Army.

THE FARMAN MONITOR I.

Developed in collaboration with M. Stampe of the Belgian Stampe et Renard company, the Monitor I first flew on July 11, 1952, powered by a 140 h.p. SNECMA Renault 4 Pei four-cylinder in-line inverted air-cooled engine.

Its structure is similar to that of the Monitor IV, of which a full description is given under the "Stampe et Renard" heading in the Belgian section of this work.



The Farman Monitor I (140 h.p. SNECMA Renault 4 Pei engine).

DIMENSIONS.—
Span 9.44 m. (30 ft. 11 in.).
Length 6.80 m. (22 ft. 3½ in.).
Height 2.825 m. (9 ft. 3 in.).
WEIGHTS.—
Weight empty 560 kg. (1,232 lb.).
Weight loaded 820 kg. (1,804 lb.).
PERFORMANCE.—
Max. speed at S/L. 210 km.h. (130.4 m.p.h.).
Min. speed without flaps 84 km.h. (52 m.p.h.).
Min. speed with flaps 72 km.h. (44.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 4 min. 30 sec.
Absolute ceiling 5,500 m. (18,040 ft.).
Endurance 3 hours.

THE FARMAN MONITOR II.

The Monitor II, which won the 1953 competition for primary trainers meeting the requirements of the S.A.L.S. (now S.F.A.S.A.), is a development of the Monitor I. The wings are of metal construction with metal covering forward of the spar and the power-plant is a 220 h.p. Salmson-Argus eight-cylinder inverted Vee air-cooled engine.

The Monitor II flew for the first time on August 5, 1955.

DIMENSIONS.—
Span 9.44 m. (30 ft. 11 in.).
Length 7.28 m. (22 ft. 10 in.).
Height 2.20 m. (7 ft. 2½ in.).
WEIGHTS.—
Weight loaded 802 kg. (1,765 lb.).
PERFORMANCE.—
Max. speed 270 km.h. (168 m.p.h.).
Cruising speed 240 km.h. (149 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Duration 3 hours.

THE FARMAN MONITOR III.

The Monitor III is the original prototype Monitor I re-engined with a 170 h.p. SNECMA Regnier 4 L02 in place of the 140 h.p. SNECMA Renault 4 Pei engine. It made its first flight on June 15, 1954.

DIMENSIONS.—
Span 9.44 m. (30 ft. 11 in.).
Length 7.28 m. (22 ft. 10 in.).
Height 2.20 m. (7 ft. 2½ in.).
PERFORMANCE.—
Max. speed at S/L. 225 km.h. (140 m.p.h.).
Min. speed without flaps 84 km.h. (52 m.p.h.).
Min. speed with flaps 72 km.h. (44.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min. 30 sec.
Absolute ceiling 6,300 m. (20,665 ft.).

FOUGA



The Fouga C.M.170R Magister Trainer (two Turbomeca Marboré II turbojet engines).

AIR-FOUGA.

HEAD OFFICE: 90, RUE DE MIROMESNIL, PARIS (8E).

WORKS: AIRE-SUR-ADOUR, TOULOUSE.

AERODROME: TOULOUSE-BLAGNAC.

Director General: W. Durodié.

Manager: Georges Glasser.

In September, 1956 the five French firms Breguet, Dassault, Morane-Saulnier, Sud-Est Aviation and Ouest-Aviation formed a limited liability company, each with equal shares, to operate the aircraft works of the Etablissements Fouga. The new firm is known as Air-Fouga and employs some 600 persons.

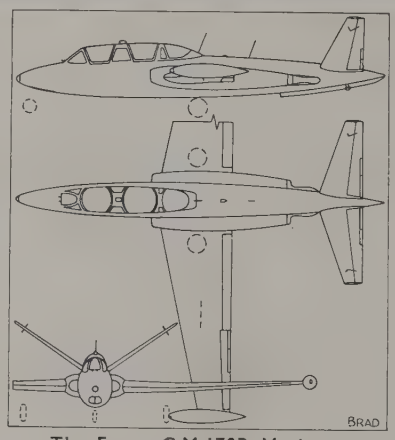
The works at Aire-sur-Adour, covering an area of 14,000 m.² (150,640 sq. ft.), is situated alongside an aerodrome which the company has built with the assistance of the local municipality and the State.

The main Fouga product is the C.M. 170R Magister twin-jet trainer which has been ordered by the French Air Force. The first production order for a series of 95 has been increased to a total of 350 aircraft. Deliveries began in the summer of 1956, and a total of 80 had been delivered by August, 1957.

Several new aircraft have been developed from the C.M.170 and details of these are given hereafter.

THE FOUGA C.M.170R MAGISTER.

The C.M.170R is a light two-seat twin-jet trainer which is in production for the French Air Force. The contract for three prototypes was signed on June 27, 1951, and the first of these flew for the first time on July 23, 1952. A pre-production order for ten aircraft was placed in June, 1953 and the first aircraft of this order made its maiden flight on July 7, 1954. An order for the series production of 95



The Fouga C.M.170R Magister.

aircraft was signed on January 13, 1954, and has been increased to a total of 350 aircraft. The first production Magister flew at Toulouse on February 29, 1956 and delivery was scheduled to reach twelve a month by the autumn of 1957.

The C.M.170R prototypes underwent numerous evaluations by twenty specialised teams representing nine different countries, and suggestions and improvements put forward as the result of these trials are incorporated in the production aircraft. In consequence of these evaluations and the modifications and improvements resulting therefrom, a recommendation by the Military Agency for Standardisation, London, to standardise on the C.M.170R for basic and intermediate training in N.A.T.O. countries was made in September, 1954.

The Federal German Government has ordered 250 Fouga Magisters for the new German Air Force. The first 40 complete aircraft and a considerable number of sub-assemblies are being supplied by Fouga and the first two of these were flown to Germany on May 28, 1957. The remainder will be built in Germany by Flugzeug Sud-Union, which represents an association of the Heinkel and Messerschmitt companies.

A licence to build the Magister in Israel was granted in September, 1957 to Bedek Aircraft Ltd. of Lydda Airport.

TYPE.—Light twin-jet two-seat trainer suitable for basic, intermediate and specialised training.

WINGS.—Mid-wing cantilever monoplane. NACA 64 Series wing section, thickness/chord ratio varying from 19% at root to 12% at tip. Aspect ratio 7.42. Chord 2.18 m. (7 ft. 2 in.) at root, 0.87 m. (2 ft. 10 in.) at tip. Taper ratio 0.40. No dihedral. Leading-edge sweepback 13°, trailing-edge sweepback nil. Single-spar structure with aluminium-alloy stressed skin. Hydraulically-operated all-metal slotted high-lift flaps of area-increasing type. Automatic tabs in ailerons. All later production aircraft to have servo-control ailerons. Retractable air brakes in upper and lower surfaces. Trailing-edge fences between air brakes and ailerons. Total flap area 4.24 m.² (45.64 sq. ft.). Total aileron area 1.46 m.² (15.72 sq. ft.). Gross wing area 17.30 m.² (186.1 sq. ft.).

FUSELAGE.—Oval all-metal semi-monocoque stressed-skin structure.

TAIL UNIT.—Butterfly type, the two tapered surfaces forming an inner angle of 110°. All-metal single-spar structure. Statically and aerodynamically balanced elevators. Projected areas horizontal 3.71 m.² (40 sq. ft.), vertical 2.60 m.² (28 sq. ft.). Span of tail 4.38 m. (14 ft. 4½ in.).



The Fouga C.M. 170R Magister (two Turbomeca Marboré II turbojet engines) as supplied to the German Air Force.



The Fouga C.M. 175 Magister Marine Naval Trainer (two Turbomeca Marboré II turbojet engines).

LANDING GEAR.—Messier retractable nose-wheel type. Hydraulic actuation. Steerable nose-wheel with anti-shimmy device. Messier wheels and hydraulic brakes. Wheel-base 4.49 m. (14 ft. 9 in.). Track 3.80 m. (12 ft. 6¾ in.).

POWER PLANT.—Two Turbomeca Marboré II turbojet engines (400 kg.=880 lb. s.t. each) partially buried in the sides of the fuselage aft of the wings and enclosed in symmetrical side protuberances which extend from the air inlets forward of the wing root leading-edges to the jet exits just forward of the tail-unit. The two engines are identical and interchangeable. Main fuel in two fuselage tanks of 255 litres (56 Imp. gallons) and 475 litres (104 Imp. gallons) capacity respectively. Total internal fuel capacity 730 litres (160 Imp. gallons). Two jettisonable wing-tip tanks (125 litres=27.5 Imp. gallons each) may be fitted. Oil capacity 24.4 litres (5.37 Imp. gallons).

ACCOMMODATION.—Tandem cockpits under continuous transparent canopy. Hinged sections over cockpits open upward and rearward. Pupil in front seat, instructor in rear. All flying, brake and engine controls duplicated. Emergency landing-gear and air brake controls in front cockpit only. Cockpits are pressurised and air-conditioned by SEMCA turbo-refrigeration equipment driven by air bleeds from engine compressors. Individual oxygen supply with regulator in each cockpit. VHF radio, Lear-ADF 14B radio compass and interphone equipment. Blind-flying equipment.

ARMAMENT.—Two 7.5 mm. machine-guns (200 r.p.g.) in fuselage nose. Gyro gunsight in each cockpit, that in rear cockpit fitted with additional periscopic sight. Camera gun. Racks for four 25 kg. (55 lb.) air-to-ground rockets or for two 50 kg. (110 lb.) bombs may be fitted under each wing.

DIMENSIONS.—
Span (without tip tanks) 11.32 m. (37 ft. 2 in.).
Span (with tip tanks) 12.14 m. (39 ft. 10 in.).
Length 10.06 m. (33 ft.).
Height 2.8 m. (9 ft. 2 in.).

WEIGHTS.—
Weight empty with fixed equipment 2,150 kg. (4,740 lb.).
Normal weight loaded 3,000 kg. (6,614 lb.).
Max. permissible A.U.W. 3,200 kg. (7,055 lb.).

PERFORMANCE.—
Max. speed at S/L at 2,700 kg. (5,953 lb.) A.U.W. 675 km.h. (419 m.p.h.).
Max. speed at 7,000 m. (22,950 ft.) at 2,700 kg. (5,953 lb.) A.U.W. 710 km.h. (441 m.p.h.).
Max. rate of climb at S/L at 2,920 kg. (6,437 lb.) A.U.W. 1,020 m./min. (3,345 ft./min.).
Climb to 6,000 m. (19,700 ft.) at 2,920 kg. (6,437 lb.) A.U.W. 10 min.
Service ceiling 12,200 m. (40,025 ft.).
Take-off run at 2,920 kg. (6,437 lb.) A.U.W. 580 m. (1,900 ft.).
Take-off distance to clear 15.25 m. (50 ft.) at 2,920 kg. (6,437 lb.) A.U.W. 880 m. (2,890 ft.).
Landing distance from 15.25 m. (50 ft.) at 3,070 kg. (6,765 lb.) A.U.W. 820 m. (2,690 ft.).

NOTE.—Above performance figures based on flight tests conducted by Centre d'Essais en Vol, Brétigny.

THE FOUGA C.M. 175 MAGISTER MARINE.

The C.M. 175 is a naval trainer version of the C.M. 170R. Two prototypes and 30 production aircraft have been ordered by the French Navy.

The C.M. 175 is generally similar to the C.M. 170R but incorporates certain modifications to meet naval requirements. These include catapult equipment, arrester gear and two separate rearward-sliding hoods for the crew. The strengthened Messier undercarriage is 0.15 m. (6 in.) longer than on the C.M. 170R, but is compressed during retraction so that the wheel-wells have not had to be modified.

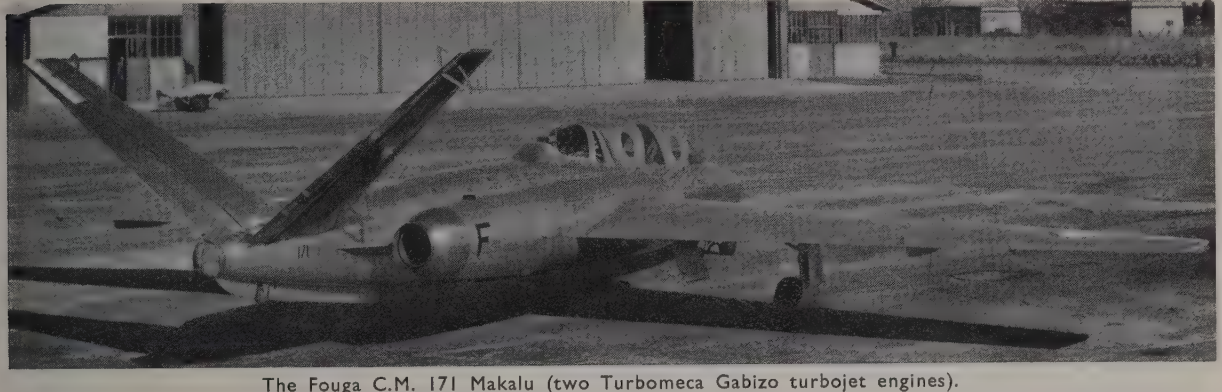
The first prototype C.M. 175 flew for the first time on July 31, 1956, and completed simulated deck-landing trials at the R.A.E., Bedford, later in that year. Both prototypes have since carried out deck trials on H.M.S. *Bulwark*.

The production C.M. 175 will be used as a deck-landing and fighter trainer.

THE FOUGA C.M. 171 MAKALU.

The C.M. 171 is a special version of the C.M. 170R Magister which is serving as a flying test-bed for the new Turbomeca Gabizo turbojet engine (1,100 kg.= 2,420 lb. s.t.). The most important modification is that the wing span has been increased by the addition of a centre-section, on which are mounted the engine nacelles. The engines are thus completely detached from the fuselage, and the undercarriage track is automatically increased.

It is hoped to make high-altitude test flights at between 15,000 and 19,000 m. (45,750-58,000 ft.) with this aircraft, which made its first flight on November 5, 1956. In an early test flight it climbed to 12,000 m. (40,000 ft.) in 9 min. 20 sec. from release of brakes.



The Fouga C.M. 171 Makalu (two Turbomeca Gabizo turbojet engines).

HUREL-DUBOIS

SOCIÉTÉ DE CONSTRUCTION DES AVIONS HUREL-DUBOIS.

HEAD OFFICE AND WORKS: ROUTE DE VERRIÈRES MEUDON-VILLACOUBLAY (SEINE-ET-OISE).

Avions Hurel-Dubois was formed to develop and put into practice the theories of M. Hurel regarding the advantages of using wings of high aspect ratio. Theoretical studies and wind-tunnel tests had shown that the aspect ratio of a monoplane wing could be doubled or even trebled when the wing was braced with suitably designed lift struts, without any increase in structure weight, thereby allowing an increase in all-up weight and a considerable increase in useful load with the same power.

The company's first product, the H.D. 10 experimental monoplane, completed its trials with success and as a result the French Government ordered two twin-engined aircraft of the same general configuration. The first, the H.D. 31, made its first flight on January 27, 1953, and the second, the higher-powered H.D. 32, on December 29, 1953. A second H.D. 32 prototype made its maiden flight on February 11, 1955.

Both prototypes of the H.D. 32 were later re-engined with two 1,525 h.p. Wright 982 engines and re-designated the



The Hurel-Dubois H.D. 321 Transport (two 1,525 h.p. Wright engines).

H.D. 321-01 and H.D. 321-02 respectively. One was lost when a wing entered the water during a bank over Rio de Janeiro Bay in poor visibility on October 30, 1956.

Two orders for a total of eight developed H.D. 34's have been received from the Institut Géographique National, and the first of these flew on February 26, 1957.

In conjunction with Avions Hurel-Dubois, the British company of F. G. Miles, Ltd. has fitted an Hurel-Dubois type of wing to an Aerovan light freight aircraft for evaluation, under the designation H.D.M. 105. A description of this aircraft appears under "Miles" in the British section of this annual.

THE HUREL-DUBOIS H.D. 321.

The H.D. 321 is the production version of the H.D. 32 prototypes, which originally had two 1,200 h.p. Pratt & Whitney R-1830-92 engines. The first H.D. 321 made its first flight on December 22, 1955.

TYPE.—Twin-engined Cargo-carrying monoplane.

WINGS.—High-wing braced monoplane. Aspect ratio 20.2. Wing in three sections, a rectangular centre-section and two tapering detachable outer sections. Centre-section chord 2.4 m. (7 ft. 10½ in.). Outer wings braced with single lift struts attached at their inner ends to small wing stubs which are also braced to the engine nacelles. Conventional ailerons with automatic tab in port aileron and controllable tab in starboard. Two spoiler surfaces with controls synchronised with that of ailerons. Double-slotted Fowler-type flaps. Entire wing of all-metal construction. Gross wing area 100 m.² (1,076 sq. ft.).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type with main fin faired into fuselage by a long dorsal fin, and two auxiliary fins mounted on the tailplane. All-metal structure. Statically and aerodynamically balanced control surfaces. Elevator control surfaces in four parts, two inboard with full-span tabs, and two outboard. Rudder in two parts, lower with full-span tab and horn-balanced, upper with half-span tab. Total area of horizontal surfaces 24.5 m.² (264 sq. ft.), of vertical surfaces 24.2 m.² (260 sq. ft.).

LANDING GEAR.—Messier fixed tricycle type. All five wheels and low-pressure tyres are identical. Main shock-absorber struts in fairings between ends of small stub wings and engine nacelles. Paired main wheels enclosed in easily removable fairings which have ducted cooling for wheel brakes. Rear portions of shock strut fairings are hinged to serve as air-brakes. Steerable nose-wheel in readily removable fairing. Main wheel track 7 m. (22 ft. 11½ in.).

POWER PLANT.—Two 1,525 h.p. Wright 982 C9 HE1 nine-cylinder radial air-cooled engines. Hamilton Standard constant-speed feathering airscrews. All fuel in wings. In each wing there are three 500 litre (110 Imp. gal.) and one 300 litre (66 Imp. gal.) tanks which supply engine through a 65 litre (14.4 Imp. gal.) auxiliary tank in engine nacelle. Cross-feed for each engine to be fed, if necessary, from opposite wing tanks.

ACCOMMODATION.—Provision for crew of three, pilot and co-pilot side-by-side with dual controls, and navigator/radio-operator behind the second pilot. Crew compartment heated and soundproofed. The unobstructed main cabin may carry either freight or passengers, or mixed load. Cabin dimensions: length 12.98 m. (42 ft. 6 in.), width at floor 2.2 m. (7 ft. 2½ in.), height above floor 2.14 m. (7 ft. 0 in.), volume above floor 58 m.³ (2,115 cub. ft.), volume usable for freight, with gangway provision, 40.8 m.³ (1,441 cub. ft.), height of cabin floor above ground 1.07 m. (3 ft. 6 in.). Main cargo loading door 2 m. × 2 m. (6 ft. 6 in.) square on port side aft of wing. A small door on same side forward of wing for crew and passengers. Freight holding-down rings in floor and sides of fuselage with necessary harness, etc. Up to 44 passengers may be carried.

DIMENSIONS.—
Span 45.3 m. (148 ft. 7½ in.).
Length 23.27 m. (76 ft. 4 in.).
Height 8.73 m. (28 ft. 7½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 11,112 kg. (24,498 lb.).
Payload (500 km. (310 mile) stage, without reserves) 6,490 kg. (14,308 lb.).
Payload (1,000 km. (620 mile) stage, without reserves) 5,910 kg. (13,030 lb.).
Gross take-off weight 18,700 kg. (41,200 lb.).
Wing loading 187 kg./m.² (38.4 lb./sq. ft.).
Power loading 6.14 kg./h.p. (13.53 lb./h.p.).

PERFORMANCE.—
Cruising speed (54.8% rated power) 275 km.h. (172 m.p.h.).
Stalling speed 120 km.h. (74.6 m.p.h.).
Rate of climb at S/L. 287 m./min. (940 ft./min.).
Rate of climb at S/L., one engine out, 77 m./min. (252 ft./min.).
Take-off field length 1,100 m. (3,609 ft.).
Landing distance from 15 m. (50 ft.) at full A.U.W. 570 m. (1,870 ft.).
Max. range 2,200 km. (1,370 miles).

THE HUREL-DUBOIS H.D. 34.

The type number H.D. 34 has been given to a version of the H.D. 321 which has been specially developed as a photographic aircraft meeting the requirements of the Institut Géographique National.

Altogether eight H.D. 34's have been ordered by the I.G.N., and the first of these flew on February 26, 1957.

The H.D. 34 differs from the H.D. 321 by having a slightly longer front fuselage which accommodates a photographer/navigator's post in the extreme nose. The twin-wheel nose landing gear is mounted off-centre and is retractable.

The H.D. 34 will carry two vertical cameras with 32 spare reels of film, each weighing 68 kg. (150 lb.), and two oblique cameras. It has a crew of five, including two camera operators. Fuel capacity is increased to 6,400 litres (1,410 Imp. gallons).

In all other respects the two aircraft are similar. The performance of the H.D. 34 is the same as that guaranteed for the H.D. 321.

The H.D. 34 has been required to operate three types of missions:—

1. A seven-hour mission involving a 600 km. (375 miles) flight to the operating area, with 2,600 kg. (5,740 lb.) of photographic equipment; photography at a height of 3,000 m. (9,800 ft.) and at a cruising speed of 200 km.h. (124 m.p.h.), and return.

2. An eight-hour mission involving an 800 km. (500 miles) flight to the operating area, with 2,600 kg. (5,740 lb.) of photographic equipment; photography at a height of 5,000 m. (16,400 ft.) and at a cruising speed of 280 km.h. (174 m.p.h.); and return.

3. An eight-hour mission involving an 800 km. (500 miles) flight to the operating area, with 850 kg. (1,870 lb.) of photographic equipment; photography at a height of 7,000 m. (23,000 ft.) and at a cruising speed of 275 km.h. (171 m.p.h.) and return.



The Hurel-Dubois H.D. 34 Photographic aircraft as supplied to the Institut Géographique National.

JODEL

SOCIÉTÉ DES AVIONS JODEL.

HEAD OFFICE AND WORKS: ROUTE DE SEURRE, BEAUNE (CÔTE-D'OR).

The Société des Avions Jodel was formed in March, 1946, by MM. Jean Delemontez and Edouard Joly, with the former acting as business and technical manager and the latter as test pilot.

Its first activities were concerned with the repair of gliders and light aircraft of the Service d'Aviation Légère et Sportive on behalf of the State.

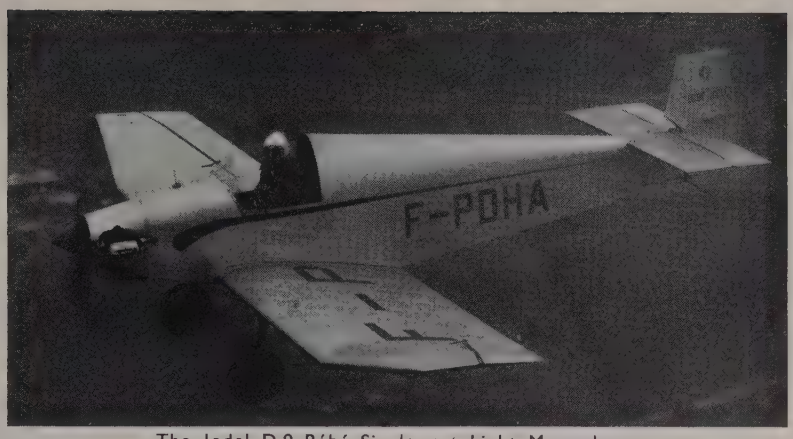
In the meantime the company designed and built the D.9 single-seat light monoplane, the Bébé Jodel, which made its first flight in January, 1948. This aeroplane, which has received its airworthiness certificate with various power-plants, is intended for the amateur constructor.

As the result of official tests with the D.9, the French authorities placed an order for the development and construction of two prototypes of a two-seat model, the D.11, fitted with the 45 h.p. Salmson, and the D.111, fitted with the 75 h.p. Minié engine. Subsequent developments of the D.11 are the D.112 and D.117, which have a 65 h.p. and 90 h.p. Continental engine respectively.

The D.117 is being produced by the Société Aéronautique Normande. Etablissements Wassmer are also building a de-luxe version of the D.112 with 90 h.p. Continental engine, under the designation of Jodel-Wassmer D.120.

Many hundreds of kits of the single-seat Bébé Jodel and of the two-seat models have been delivered to purchasers in all parts of the World.

In addition, various versions of the D.9 and the D.112 have been produced by the Pasotti company in Italy, Aero Flugzeugbau Hubert Zuerl in Germany and Aero-Difusión S.L. in Spain.



The Jodel D.9 Bébé Single-seat Light Monoplane.

THE JODEL D.9 BÉBÉ.

TYPE.—Single-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane. Single-spar one-piece wing with wide-span centre-section of constant chord (1.80 m.= 5 ft. 10 in.) and thickness and two tapering outer portions set at a coarse dihedral angle (14°). Spar and ribs of spruce and plywood with fabric covering. Ailerons on outer portions. Gross wing area 9 m.² (96.8 sq. ft.).

FUSELAGE.—Rectangular spruce and plywood structure.

TAIL UNIT.—Cantilever monoplane type. No fin. Spruce and plywood frames with plywood-covered tailplane and fabric-covered rudder and elevators.

LANDING GEAR.—Divided type. Cantilever legs with rubber-in-compression springing. Leaf spring tail-skid. Cable-brakes.

POWER PLANT.—Either one 25 h.p. Poinsard or 34 h.p. A.B.C. Scorpion two-cylinder horizontally-opposed or 26 h.p. Volkswagen flat-four air-cooled engine. Fuel tank in fuselage.

ACCOMMODATION.—Single open cockpit.

DIMENSIONS.—
Span 7 m. (22 ft. 11 in.).
Length (Poinsard) 5.35 m. (17 ft. 6 in.).
Length (Scorpion) 5.40 m. (17 ft. 8½ in.).
Length (Volkswagen) 5.45 m. (17 ft. 10½ in.).

WEIGHTS (Poinsard engine).—
Weight empty 143 kg. (315 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 253 kg. (557 lb.).

WEIGHTS (Scorpion engine).—
Weight empty 160 kg. (352 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 270 kg. (594 lb.).

WEIGHTS (Volkswagen engine).—
Weight empty 162 kg. (356 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 272 kg. (598 lb.).

PERFORMANCE (Poinsard engine).—
Max. speed 152 km.h. (94.4 m.p.h.).
Cruising speed 115 km h. (71.4 m.p.h.).
Landing speed 47 km h. (29 m.p.h.).
Initial rate of climb 150 m./min. (492 ft./min.).
Take-off run 55 m. (60 yds.).
Landing run 70 m. (76 yds.).
Range 400 km. (250 miles).

PERFORMANCE (Scorpion engine).—
Max. speed 170 km.h. (105.5 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 240 m./min (787 ft./min.).
Take-off run 40 m. (44 yds.).
Landing run 70 m. (76 yds.).
Range 400 km. (250 miles).

PERFORMANCE (Volkswagen engine).—
Max. speed 150 km.h. (93 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 126 m./min. (412 ft./min.).
Take-off run 110 m. (120 yds.).
Landing run 60 m. (66 yds.).
Range 460 km. (286 miles).



The Jodel D.111 (75 h.p. Minié engine).

THE JODEL D.11.

The D.11 is a two-seat dual-control version of the D.9. Except for increased overall dimensions, a wider fuselage and enclosed side-by-side cockpit, the D.11 conforms in layout and structure to the D.9. The D.11, which is fitted with a 45 h.p. Salmson radial engine, is also being marketed in kit form.

DIMENSIONS.—
Span 8.2 m. (26 ft. 10 in.).
Length 6.2 m. (20 ft. 4 in.).
Height 2.05 m. (6 ft. 9 in.).
Wing area 12.7 m.² (136.6 sq. ft.)

WEIGHTS.—
Weight empty 270 kg. (594 lb.).
Disposable load 215 kg. (473 lb.).
Weight loaded 485 kg. (1,067 lb.).

PERFORMANCE.—
Max. speed 170 km.h. (105.5 m.p.h.).
Cruising speed 155 km.h. (96 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Initial rate of climb 140 m./min. (460 ft./min.).
Take-off run (no wind) 160 m. (175 yds.).
Take-off to 20 m. (66 ft.) 360 m. (395 yds.).
Landing run 80 m. (85 yds.).
Range 600 km. (375 miles).

THE JODEL D.111.

The D.111 is identical to the D.11 except that it is fitted with a 75 h.p. Minié flat-four engine. A small series of the D.111 is under construction.

DIMENSIONS.—
Same as D.11 except:
Length 6.28 m. (20 ft. 7 in.).

WEIGHTS.—
Weight empty 280 kg. (616 lb.).
Weight loaded 520 kg. (1,144 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Max. cruising speed 170 km.h. (105.5 m.p.h.).
Economic cruising speed 155 km.h. (96 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Rate of climb 220 m./min. (720 ft./min.).
Take-off run (no wind) 90 m. (98 yds.).
Take-off to 20 m. (66 ft.) 260 m. (284 yds.).
Landing run 90 m. (98 yds.).
Range 700 km. (435 miles).



The Jodel-Wassmer D.120 Paris-Nice (90 h.p. Continental C90 engine).

THE JODEL D.112 CLUB.

The D.112 is the D.11 fitted with a 65 h.p. Continental flat-four engine.

DIMENSIONS.—
Same as D.111.

WEIGHTS.—
Weight empty 320 kg. (705 lb.).
Weight loaded 505 kg. (1,113 lb.).

PERFORMANCE.—
Max. speed 180 km.h. (112 m.p.h.).
Max. cruising 170 km.h. (105.5 m.p.h.).
Economic cruising 150 km.h. (93 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Rate of climb 175 m./min. (575 ft./min.).
Take-off run (no wind) 220 m. (240 yds.).
Take-off to 20 m. (66 ft.) 300 m. (328 yds.).
Landing run 150 m. (164 yds.).
Range 600 km. (373 miles).

THE JODEL D.117 GRAND TOURISME.

Basically similar to the Jodel D.11, but powered by a 90 h.p. Continental C90-14F engine, the D.117 is being produced by the Société Aéronautique Normande. A full description appears under the entry for that company.

THE JODEL D.120 PARIS-NICE.

The Paris-Nice is a de-luxe version of the D.112 with 90 h.p. Continental C90 engine, which is being built in quantity by Etablissements Wassmer. Further details will be found under the entry for that company.

JURCA

MARCEL JURCA.

ADDRESS: 2, RUE DESCHAMP PHILIPPE, LA GARENNE COLOMBES (SEINE).

Under the direction of M. Marcel Jurca, a young ex-military pilot and electrical engineer, the members of the Aero Club of Courbevoie have built a prototype of the M.J.2 Tempête single-seat light aircraft, which incorporates many Jodel components.

THE JURCA M.J.2 TEMPETE.

TYPE.—Single-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section. Chord 1.40 m. (4 ft. 7 in.). Incidence 4°. No dihedral. All-wood one-piece single-spar structure with fabric covering. Fabric-covered wooden ailerons. Total area of ailerons 1.0 m.² (10.76 sq. ft.). Wing area 7.98 m.² (85.90 sq. ft.).

FUSELAGE.—All-wood structure of basic rectangular section, plywood-covered.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Tailplane and fin plywood-covered, elevators and rudder fabric-covered. Trim-tab on starboard elevator. Areas: fin 0.645 m.² (6.94 sq. ft.), rudder 0.54 m.² (5.81 sq. ft.), tailplane 0.85 m.² (9.15 sq. ft.), elevators 0.80 m.² (8.61 sq. ft.). Tailplane span 2.50 m. (8 ft. 2 in.).

LANDING GEAR.—Non-retractable two-wheel type. Cantilever main legs of Jodel design, with Jodel D.112 wheels and size 420 × 150 tyres. No brakes. Tailskid. Wheel track 2.30 m. (7 ft. 6½ in.).



The Jurca Tempête (65 h.p. Continental A65 engine).

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine, driving two-blade fixed-pitch wooden airscrew. Provision for fitting 90 h.p. Continental engine. Jodel engine-mounting and cowling. Jodel fuel tank, capacity 60 litres (13.2 Imp.. gallons) aft of firewall in fuselage.

ACCOMMODATION.—Single seat under long rearward-sliding transparent canopy. Provision for parachute.

DIMENSIONS.—
Span 6.0 m. (19 ft. 8 in.).
Length 5.7 m. (18 ft. 8½ in.).
Height 2.4 m. (7 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight loaded 400 kg. (882 lb.).
Wing loading 50 kg./m.² (10.24 lb./sq. ft.).
Power loading 6.1 kg./h.p. (13.45 lb./h.p.).

PERFORMANCE.—
Max. speed 193 km.h. (120 m.p.h.).
Cruising speed 170 km.h. (106 m.p.h.).
Landing speed 80 km.h. (50 m.p.h.).
Rate of climb 170 m./min. (555 ft./min.).
Service ceiling 3,500 m. (11,500 ft.).
Endurance 3 hr. 20 min.

LEDUC

RENÉ LEDUC ET FILS.

HEAD OFFICE AND WORKS: 158, QUAI DE BEZONS, ARGENTEUIL (SEINE-ET-OISE).

René Leduc has for many years concentrated on the development of the "athodyd" or ramjet type of power-plant for aircraft. As far back as 1935 he was successful in producing a small unit which developed a thrust of 4 kg. (8.8 lb.) at 300 m./sec. (985 ft./sec.).

His first complete ramjet-driven aircraft was the 0.10 monoplane, which has been described fully in earlier editions of "All the World's Aircraft."

Two prototypes of the larger Leduc O.21 were next built, the first making its initial flight from a carrier aircraft on May 16, 1953. These aircraft proved completely successful and are now being used to flight test components and equipment of the O.22 supersonic interceptor. Both the O.21 and O.22 were developed to the order of the French Air Ministry, but official support may be withdrawn under the 1957 "cut-back" in military contracts.

Leduc has conducted an extensive test programme on the unique jettisonable cockpit which is fitted to the O.21 and O.22 with the aid of dynamically-similar models launched in flight from a Languedoc carrier aircraft. In an emergency, the pilot of a Leduc ramjet aircraft would have to operate only one control to release the entire cockpit structure from the remainder of the airframe.

THE LEDUC 0.21.

The Leduc O.21 is about one-third larger than the earlier O.10, which was the first piloted aircraft driven by a ram-jet or athodyd. This type of power-plant cannot operate before sufficient air velocity is introduced into the tube. The O.21 must, therefore, be taken into the air by a carrier aircraft and reach a speed of about 320 km.h. (200 m.p.h.) before the fuel can be turned on and ignited.

Two prototypes of the O.21 were built and they are now being used to flight-test components and equipment of the Leduc O.22 supersonic interceptor.

TYPE.—Single-seat Experimental Ramjet monoplane.

WINGS.—Cantilever mid-wing monoplane. Bi-convex wing section tapers from 10% thickness/chord at root to 8% at tip. Aspect ratio 5.5. Chord 2.64 m. (8 ft. 8 in.) on centre-line, 1.19 m. (3 ft. 11 in.) at tip. Leading-edge sweep 14°. Dihedral 3°. Incidence 0°. All-metal integrally-machined structure. Plain ailerons and camber



The Leduc O.21 High-speed Research Ramjet Monoplane.

flaps. Wing-tip nacelles, originally to house turbojets, now contain balancer wheels of landing gear and function as end-plates to increase effective span. Wing area 22 m.² (237 sq. ft.).

FUSELAGE.—Tubular open-ended fuselage duct is a double-skinned light alloy structure mounted on rear part of cockpit nacelle by upper and lower supports.

TAIL UNIT.—Cantilever monoplane type. Light alloy structure. Multi-spar tailplane and fin attached to duct by angle brackets. Two halves of elevator completely independent to avoid breaking up flow through duct.

LANDING GEAR.—Two main wheels in tandem retract upward, forward and aft of a single fixed shock-absorber. Small retractable tail-wheel and wing-tip balancer wheels.

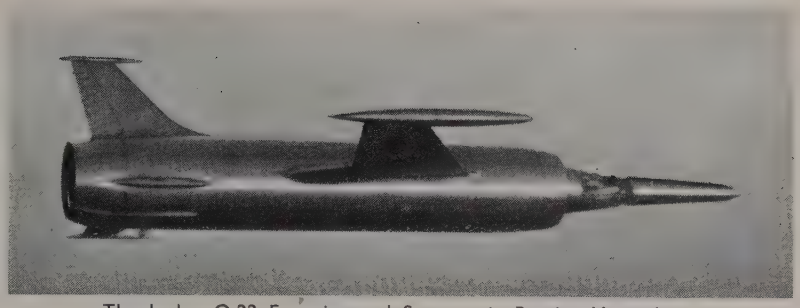
POWER PLANT.—Leduc "athodyd" or thermo-propulsive fuselage duct developing 6,500 kg. (14,300 lb.) s.t. at 1,000 km.h. (620 m.p.h.) at S/L. Air enters annular opening surrounding pilot's cockpit, passes to centre of fuselage where it enters a series of six internal cylindrical ducts of increasing size, the leading-edge of each duct being ringed with fuel injectors. (There was a total of 500 burners on the 0.10, which had five internal ducts). The resultant mixture is ejected from the rear end of the fuselage as a high-velocity jet. Fuel feed by electrically-driven pump. Fuel carried in wing torsion box and between double skin of central portion of fuselage duct. Engine lit by the exhaust from a Turbomeca Artouste turbine mounted at aft end of central nacelle.

ACCOMMODATION.—Light alloy monocoque nacelle with tubular framework at forward end carrying pilot's seat, instruments, etc. Transparent nose cone slides forward to give access to seat and is sealed by inflatable ring when shut. Pressurised cabin. Entire forward portion of nacelle can be detached in an emergency and lowered to the ground by three parachutes stowed behind rear pressure bulkhead.

DIMENSIONS.—
Span 11.6 m. (3ft. 1 8 in.).
Length 12.5 m. (41 ft.).
Height 2.75 m. (9 ft. 3 in.).

WEIGHTS AND LOADING.—
Weight empty 3,800 kg. (8,380 lb.).
Weight loaded 6,000 kg. (13,260 lb.).
Wing loading 273.4 kg./m.² (56 lb./sq. ft.).

PERFORMANCE.—
Max. speed Mach 0.87.
Rate of climb at S/L. (estimated) 200 m./sec. (39,300 ft./min.).
Rate of climb at 5,000 m. (16,400 ft.) 80 m./sec. (15,700 ft./min.).
Ceiling 20,000 m. (65,500 ft.).
Endurance 15 min.



The Leduc O.22 Experimental Supersonic Ramjet Monoplane.

THE LEDUC 0.22.

The O.22 is a supersonic development of the O.21 and is intended to be the prototype for a ramjet-powered interceptor. It has an initial loaded weight of 6 tonnes (13,200 lb.), thirty per cent. of which is fuel. The fuel is carried in the wings and between the double walls of the fuselage duct. It is estimated that the fuel consumption will be under 2.5 kg./kg. s.t./hr. (2.5 lb./lb. s.t./hr.).

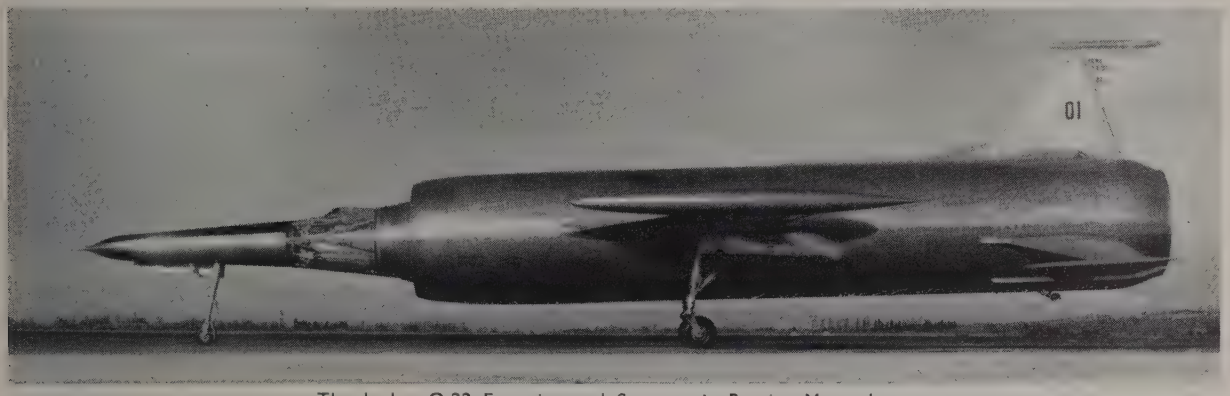
The low/mid-wing has a 30° sweepback and the tail surfaces are also swept. The landing gear is of the tricycle type, all wheels retracting into the fuselage shell, the main wheels turning through 45° and the nose-wheel through 90° in the process of retraction.

The O.22 is able to take off under its own power with the aid of a SNECMA Atar D.3 turbojet engine which is installed within the body of the athodyd.

It is estimated that the fully-developed O.22 will have a maximum speed of Mach 2 and that the equivalent ground level thrust of the athodyd at that speed will be of the order of 60,000 kg. (132,000 lb.).

The first of two prototypes was completed on June 5, 1956, and taken by road to the airfield at Istres, where it made its first flight on December 26, 1956. By March, 1957 it had completed more than 30 test flights on the power of the Atar alone and was being prepared for the first tests of its ramjet engine.

No further details are available.



The Leduc O.22 Experimental Supersonic Ramjet Monoplane.

LEGRAND-SIMON

PAUL LEGRAND.

ADDRESS : 147, AVENUE J. B. CLÉMENT, CLAMART (SEINE).

A two-seat light monoplane known as the LS.50 Dauphine has been designed and built by M. Simon, a young engineer with the Breguet company, and Paul Legrand, who is with the SNECMA organisation, as a prototype for a light economical touring, training and glider-towing aircraft. It flew for the first time on January 13, 1957. At the time of writing the LS.50 had completed its constructor's trials and was due to go to Brétigny for its official certification tests.

THE LEGRAND-SIMON LS.50.

TYPE.—Two-seat Light monoplane.

WINGS.—Braced high-wing monoplane. Constant-chord structure with single main streamline bracing strut and small auxiliary strut each side. Large trailing edge flaps.

TAIL UNIT.—Braced monoplane type. Single bracing strut each side between tail-wheel fitting and tailplane. Trim-tabs in rudder and elevators.

LANDING GEAR.—Fixed divided type with lateral Vee struts. Fully-swivelling tail-wheel.

POWER PLANT.—One 90 h.p. Continental C90 four-cylinder horizontally-opposed air-cooled engine driving two-blade fixed-pitch wooden airscrew.

ACCOMMODATION.—Two seats side-by-side in enclosed cabin, with access door on each side.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—No details available.



The Legrand-Simon LS.50 Dauphine (90 h.p. Continental C90 engine).

MAX HOLSTE

SOCIÉTÉ DES AVIONS MAX HOLSTE.

HEAD OFFICE : 17 RUE DE CHÂTEAUBRIAND, PARIS (VIIIe).

WORKS : 11 RUE GOSSET, REIMS.

President and General Director : Max Holste.

Avions Max Holste has produced several all-metal aircraft, of which the M.H. 52, M.H. 53 and M.H. 152 are the best-known.

The latest product of the company is the M.H. 1521 Broussard, the prototype of which first flew on November 17, 1952. The company is now engaged in fulfilling orders for 335 for the French Armed Services, and for a further 50 or so to meet various non-military orders. The first production M.H. 1521 flew on June 4, 1956, and the fiftieth was completed on January 25, 1957.



The Max Holste M.H. 1521 Broussard (450 h.p. Pratt & Whitney R-985 engine).

THE MAX HOLSTE M.H. 1521 BROUSSARD.

TYPE.—Six-seat General Utility monoplane.

WINGS.—High-wing rigidly-braced monoplane. NACA 44013 wing section. Aspect ratio 7.5. Chord 1.850 m. (6 ft.) constant. Dihedral 1°30′. Incidence 3°. All-duralumin structure. Central two-spar box with detachable leading-edge. Slotted flaps and ailerons hinged to rear spar. Ailerons arranged to droop 13° when flaps are lowered to 45° while still retaining their differential action. Each single bracing strut is a steel tube with dural sheet fairing. Gross wing area : 25.4 m.² (273.3 sq. ft.).

FUSELAGE.—Duralumin structure with stressed skin canopy.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Duralumin frames with metal-covered fixed surfaces and fabric-covered elevators and rudders. Controllable trim-tabs in both elevators and in port rudder.

LANDING GEAR.—Fixed tail-wheel type. Spring steel (Cessna licence) main legs. Orientable tail-wheel with self-centering device. ERAM oleo-pneumatic shock-absorber. Brakes on main wheels.

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 nine-cylinder radial air-cooled engine. Hamilton Standard 2.AD. 30 constant-speed airscrew. Fuel tanks in wing roots.

ACCOMMODATION.—Enclosed cabin seating six in three pairs, the front pair with dual controls. Large door in two parts on port side. As an ambulance can carry pilot, two stretcher cases one above other on starboard side and two sitting cases on port side. Agricultural version has spray-gear developed by Fison-Airwork Ltd. Dimensions of cabin : length 3.08 m. (10 ft. 1 in.), width 1.25 m. (4 ft. 1 in.), average height 1.35 m. (4 ft. 5 in.), volume 4.80 m.³ (169.4 cub. ft.).

DIMENSIONS.—
Span 13.745 m. (45 ft. 1 in.).
Length 8.60 m. (28 ft. 2 in.).
Height 2.80 m. (9 ft. 2 in.).

WEIGHTS AND LOADINGS (Pilot and five passengers).—
Weight empty, equipped 1,480 kg. (3,256 lb.).
Pilot 75 kg. (165 lb.).
Fuel and oil 325 kg. (715 lb.).
Useful load 535 kg. (1,177 lb.).
Weight loaded 2,500 kg. (5,500 lb.).
Wing loading 98.5 kg./m.² (20.15 lb./sq. ft.).
Power loading 5.5 kg./h.p. (4.94 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 270 km.h. (168 m.p.h.).
Max. cruising speed 250 km.h. (155 m.p.h.).
Econ. cruising speed 230 km.h. (143 m.p.h.).
Min level speed 85 km.h. (53 m.p.h.).
Rate of climb at S/L. 330 m./min. (1,082 ft./min.).
Service ceiling 5,800 m. (19,030 ft.).
Range (with 500 kg. = 1,100 lb. commercial load) 1,200 km. (745 miles).
Range (with 600 kg. = 1,320 lb. commercial load) 800 km. (500 miles).
Take-off distance to clear 15 m. (50 ft.) 325 m. (1,066 ft.).
Landing distance from 15 m. (50 ft.) 240 m. (787 ft.).



The Max Holste M.H. 1521 Broussard in its civil form.

THE MAX HOLSTE M.H. 250 SUPER BROUSSARD.

The Super Broussard, the prototype of which is due to fly in the Summer of 1958, will be a twin-engined transport capable of accommodating 17-20 passengers or 1,870 kg. (4,122 lb.) of freight. It will be a high-wing all-metal monoplane with semi-retractable tricycle landing gear and will be powered by two 600 h.p. Pratt & Whitney R-1340 Wasp engines or Turbomeca Bastan turboprops. The main wheels will retract into fairings built on to the sides of the fuselage.

An initial batch of ten Super Broussards will be built to orders from U.A.T., T.A.I. and Royal Air Maroc.

DIMENSIONS.—
Span 21.61 m. (70 ft. 1 in.).
Length 15.80 m. (51 ft. 10 in.).
Wing area 54 m.² (581 sq. ft.).

WEIGHTS (designed).—
Weight empty 4,015 kg. (8,850 lb.).
Weight loaded 6,624 kg. (14,603 lb.).

PERFORMANCE (estimated).—
Max. speed 363 km.h. (225 m.p.h.).
Cruising speed at 2,750 m. (9,000 ft.) (55% power) 280 km.h. (174 m.p.h.).
Stalling speed 102 km.h. (63.5 m.p.h.).
Take-off distance to 15 m. (50 ft.) 320 m. (1,050 ft.).
Landing distance from 15 m. (50 ft.) 490 m. (1,610 ft.).
Normal range, with allowances 970 km. (603 miles).
Max. range with allowances 1,970 km. (1,224 miles).

MAX PLAN

ADDRESS : 115, RUE BELIN, ARGENTEUIL (SEINE-ET-OISE).

M. Max Plan, chief of the supersonic tunnel at Meudon Bellevue, has designed and built a small racing aircraft. It was first flown on June 5, 1952, as the Max Plan MP.204, powered by a 75 h.p. Minié engine which was loaned by the S.A.L.S.

Since then, the aircraft has been fitted with a new engine cowling, an enlarged cockpit and other minor modifications, and has been re-designated the MP.214. In due course, M. Plan intends also to replace the Minié with a 90 h.p. Continental C90 engine, and the aircraft will then become the MP.215.

A full description of the Max Plan MP.214 appeared in the 1956-57 edition of "All the World's Aircraft."

MORANE-SAULNIER

AEROPLANES MORANE-SAULNIER.

HEAD OFFICE : 3 and 5, RUE VOLTA, PUTEAUX (SEINE).

WORKS : PUTEAUX (SEINE) AND OSSUN-LOUEY, NEAR TARBES (HAUTES-PYRENEES).

Commercial Director : S. Saulnier.

The Morane-Saulnier Company was originally formed in 1911 and its parasol monoplane fighters were flown by the French Air Force and the Royal Flying Corps in the war of 1914-18. In the inter-war period Morane-Saulnier built many notable aircraft, mainly military trainers and single-seat fighters.

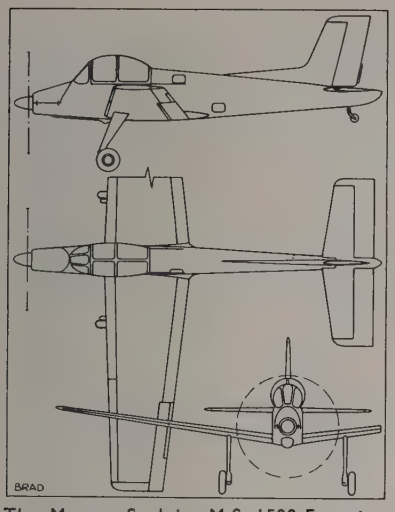
Since the war Morane-Saulnier has concentrated mainly on the design and production of trainers. Recent types are the M.S. 733 three-seat basic trainer which has been built in quantity for the French Air Force and Navy, and the M.S. 755 two-seat jet fighter trainer.

From the M.S. 755 has been developed the M.S. 760 which can be used as a two-seat side-by-side trainer or as a four-seat high-speed liaison or communications aircraft. The M.S. 760 Paris has been ordered in quantity by the French Government and is also being supplied to the Argentine Government.

Under development are the M.S. 1500 Epervier, a light turboprop-powered two-seat multi-purpose monoplane ; and the M.S. 785, a light four-jet transport.

THE MORANE-SAULNIER M.S. 1500 EPERVIER.

The M.S. 1500 is a light two-seat multi-purpose military monoplane which has been designed for cheapness of production and simplicity and economy of operation. It is powered by a 750 e.s.h.p.



The Morane-Saulnier M.S. 1500 Epervier.

Turbomeca Bastan turboprop engine, and can be armed with a variety of weapons, including machine-guns, small-calibre bombs, light missiles or air-to-air rockets or can be equipped for observation or light liaison duties.

A prototype is under construction and was due to fly before the end of 1957. The general arrangement of the M.S. 1500 can be gathered from the accompanying outline drawing.

DIMENSIONS.—
Span 12.82 m. (42 ft. 1 in.).
Length 10.16 m. (33 ft. 3 in.).
Height 3.27 m. (10 ft. 10 in.).

WEIGHTS (designed).—
Weight empty (without auxiliary tanks) 1,735 kg. (3,820 lb.).
Weight empty (with auxiliary tanks) 1,775 kg. (3,910 lb.).
Weight loaded (without auxiliary tanks) 2,500 kg. (5,500 lb.).
Weight loaded (with auxiliary tanks) 2,725 kg. (6,000 lb.).

PERFORMANCE (estimated).—
Max. speed at S/L 320 km.h. (199 m.p.h.).
Max. speed at 3,000 m. (9,840 ft.) 330 km.h. (205 m.p.h.).
Rate of climb at S/L 8.5 m./sec. (1,700 ft./min.).
T.O. to clear 15.25 m. (50 ft.) 250 m. (273 yds.).
Landing from 15.25 m. (50 ft.) 240 m. (263 yds.).
Endurance (without auxiliary tanks) 4 hrs. approx. at 3,000 m. (9,840 ft.).
Endurance (with auxiliary tanks) 7.5 hrs. approx. at 3,000 m. (9,840 ft.).

THE MORANE-SAULNIER M.S. 760 PARIS.

The M.S. 760 was designed primarily as a four-seat high-speed communications aircraft but is also easily adaptable for training and other duties. It is in its communications rôle that the M.S. 760 has been ordered by the French and Argentine Governments.

The first prototype M.S. 760 flew for the first time on July 29, 1954, and the second prototype on March 28, 1957.

An initial order for 50 for the French Services has been placed, with deliveries beginning late in 1957. Forty-eight have been ordered by the Argentine Government, the first to be delivered in March, 1958. These aircraft will be delivered in component form and assembled at the Government Factory at Cordoba.

TYPE.—Four-seat high-speed liaison or two-seat training monoplane.

WINGS.—Low mid-wing cantilever monoplane. Wing section NACA 64 A 1 (13.5) at root, (12) at tip. Aspect ratio 5.12. Chord 2.168 m. (7 ft. 1 in.) at root, 1.540 m. (5 ft. 1 in.) at tip. Dihedral 8°. Incidence 2°. All-metal structure. All-metal ailerons with static balance and spring tabs. Electrically-operated all-metal split flaps and air brakes, with emergency mechanical operation. Total area of flaps 1.54 m.² (16.57 sq. ft.). Total area of ailerons 2.30 m.² (24.75 sq. ft.). Gross wing area 18 m.² (193.68 sq. ft.).

FUSELAGE.—All-metal structure in four sections—nose section, pressurised cabin section, central engine section, and easily detachable tail-section.

TAIL UNIT.—Cantilever T-type tail. All-metal structure. Areas: fin 1.10 m.² (11.83 sq. ft.), rudder 0.53 m.² (5.70 sq. ft.), tailplane 1.57 m.² (16.89 sq. ft.), elevators (total) 1.28 m.² (13.77 sq. ft.). Tailplane span 3.40 m. (11 ft. 2 in.).

LANDING GEAR.—Retractable nose-wheel type. Electrical retraction, with emergency mechanical operation. ERAM oleo-pneumatic shock-absorbers. ERAM wheels and hydraulic brakes. Wheelbase 3.725 m. (12 ft. 2½ in.). Track 2.42 m. (7 ft. 11 in.).

POWER PLANT.—Two Turbomeca Marboré II turbojet engines (400 kg.=880 lb. s.t. each) mounted in the sides of the fuselage with air inlets in the wing roots. Rear fuselage quickly detachable to give access to engines. Main fuel tank (950 litres=210 Imp. gallons) in fuselage. Provision for two auxiliary wing-tip tanks (225 litres=49.5 Imp. gallons each). Oil capacity 20 litres (4.4 Imp. gallons).

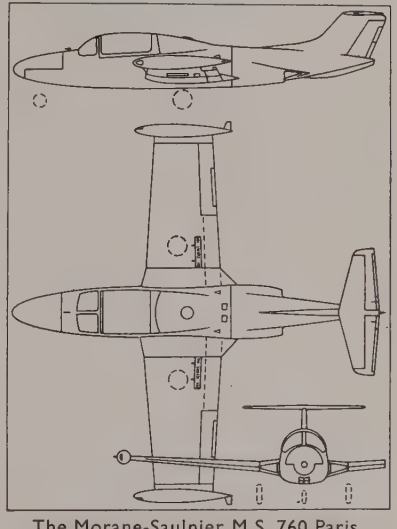
ACCOMMODATION.—Pressurised and air-conditioned cabin seating four in two pairs. Sliding and jettisonable canopy. Rear seats easily removable to convert aircraft to advanced trainer for aerobatics (with tip-tanks removed), blind-flying and night-flying, etc. Can also be adapted for weapon training, deck-landing and ship-board training.

ARMAMENT.—In weapon-training rôle armament can comprise two 7.5 mm. machine-guns in nose of fuselage, ciné gun, racks for two 50 kg. (110 lb.) bombs or four 3.5 in. rockets beneath wings. Gyro gun-sight. In a possible light tactical rôle can be armed with one 30 mm. cannon (60 rounds) in addition to two m.g. twelve rockets, or two 118-kg. (260-lb.) and two 50-kg. (112-lb.), or eight 50-kg. (112-lb.) bombs under wings.

DIMENSIONS.—
Span (over tip tanks) 10.15 m. (33 ft. 3 in.).
Length 10.05 m. (33 ft.).
Height 2.60 m. (8 ft. 6 in.).

WEIGHTS.—
Weight empty (equipped) 1,945 kg. (4,280 lb.).
Weight loaded 3,375 kg. (7,435 lb.).

PERFORMANCE (at max. A.U.W.).—
Max. speed 650 km.h. (405 m.p.h.) at S/L.
Max. speed at 7,000 m. (23,000 ft.) 555 km.h. (345 m.p.h.).
Cruising speed 570 km.h. (350 m.p.h.) at 5,000 m. (16,400 ft.).
Landing speed 155 km.h. (96 m.p.h.).
Initial rate of climb at S/L. 690 m./min. (2,264 ft./min.).
Rate of climb on one engine at 1,000 m. (3,300 ft.) 120 m./min. (420 ft./min.).
Rate of climb at 7,000 m. (23,000 ft.) 240 m./min. (780 ft./min.).
Climb to 7,000 m. (22,960 ft.) 18 min.
Service ceiling 10,000 m. (32,800 ft.).
Still-air range at 7,000 m. (22,960 ft.) 1,500 km. (930 miles).
Take-off run 750 m. (820 yds.).



The Morane-Saulnier M.S. 760 Paris.



The Morane-Saulnier M.S. 760 Paris (two Turbomeca Marboré turbojets).

NORD

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD (S.N.C.A.N.).

HEAD OFFICE: 12*bis* AVENUE BOSQUET, PARIS, (7e.)

DEVELOPMENT CENTRE: CHATILLON-SOUS-BAGNEUX (SEINE).

TEST CENTRE: LES GÂTINES.

WORKS: BOURGES (CHER), LES MUREAUX (SEINE-ET-OISE), MEAULTE (SOMME) AND LYON-VILLEURBANNE (RHÔNE).

President - Director - General: Paul Mazer.

General Secretary: Jean Otier.

Chairman of the Technical Board: Noel Daum.

Chief Engineers in charge of various departments: MM. Buret, Calvy, Decker, Dupin, Galtier, Montlaur, Pierrat, Pichon, Stauff.

Commercial Director: A. Leconte.

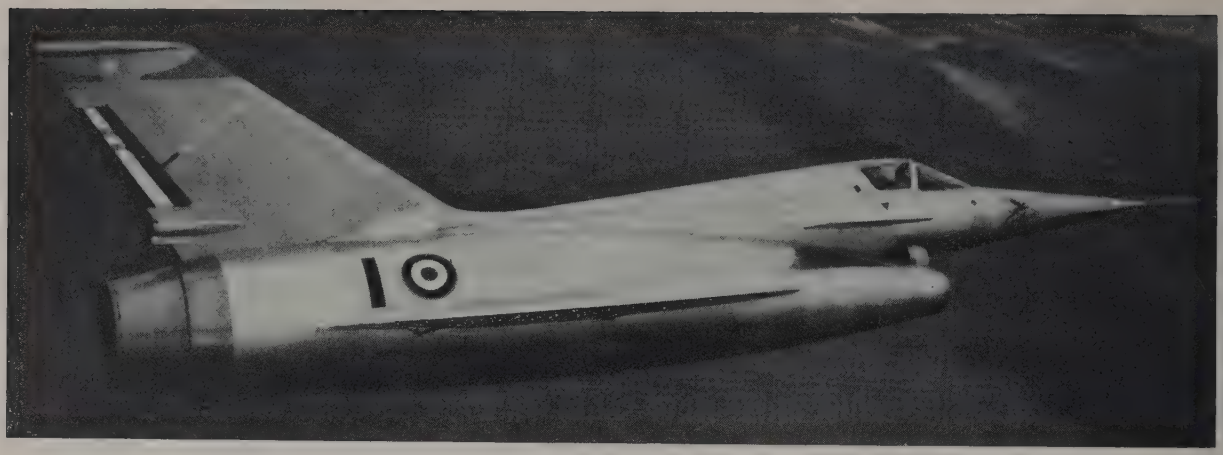
The Société Nationale de Constructions Aéronautiques du Nord was formed in 1936 under the laws for the nationalisation of the Aircraft Industry. It grouped together the former Potez, C.A.M.S. and Les Mureaux companies and also took over certain factories belonging to the Breguet concern. M. Henry Potez was the first Administrator. At the end of 1945 the Société Anonyme des Avions Caudron-Renault was incorporated in the S.N.C.A.N.

Following the liquidation of the S.N.C.A. du Centre in 1949, the Bourges factory of that society was integrated in the Nord group.

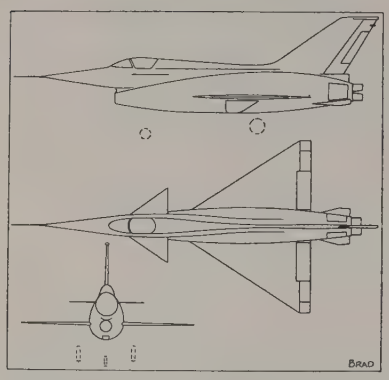
On January 1, 1953, the factory at Lyon-Villeurbanne which formerly belonged to the Arsenal de l'Aéronautique was taken over by the S.N.C.A.N.

Towards the end of 1954, on the recommendation of the Air Secretary of the Ministry of Defence, the Société Nationale de Constructions Aéronautiques du Nord and the Société Francaise d'Etudes et de Constructions de Matériels Aéronautiques Spéciaux (SFECMAS) merged under the common name of the former.

The enlarged Nord organisation continues all the activities of the two former companies, the aim of the fusion being to concentrate technical, production and financial resources. The company covers a very wide field of activities in research and development, now embracing the missile and ramjet fields, and has extensive production facilities.



The Nord 1500 Griffon II (SNECMA Atar 101E turbojet engine and Nord ramjet).



The Nord 1500 Griffon I.

THE NORD 1500 GRIFFON I AND II.

The Nord 1500 Griffon (originally Guépard) experimental aircraft is a potential light interceptor concept, designed to flight test a new airframe design capable of being equipped with a combination turbojet-ramjet propulsion unit. The prototype 1500-01 Griffon I made its first flight on September 20, 1955, powered by an orthodox SNECMA Atar 101F turbojet engine with afterburner. After the completion of the first phase of testing the airframe was modified to take a propulsion unit consisting of an Atar 101E engine and Nord ramjet. Although basically the same aircraft, the re-engined model is known as the 1500-02 Griffon II.

The Griffon II flew for the first time on January 23, 1957, and on May 17 it exceeded Mach 1 in level flight with its ramjet ignited, although not using the full power of its combination power-unit. It is claimed that this was the first time that a piloted aircraft propelled by a ramjet had exceeded the speed of sound.

The Griffon has 60° delta wings of very low thickness/chord ratio which are fitted with elevons. Low-pressure tyres and a high lift system, which combines flaps and a braking parachute, enable it to land on all types of airfields. A forward trimming plane, which gives the Griffon a tail-first layout, ensures accurate longitudinal trim at all speeds, including the transonic zone.

DIMENSIONS.—
Span approx. 7.93 m. (26 ft.).
Length approx. 14.0 m. (46 ft.).
Height approx. 5.0 m. (16 ft. 5 in.).

WEIGHT.—
Weight loaded approx. 6,000 kg. (13,225 lb.).

PERFORMANCE (approx.).—
Max. speed 1,500 km.h. (930 m.p.h.) at 3,300 m. (10,800 ft.).
Rate of climb at S/L 5,200 m./min. (17,060 ft./min.).

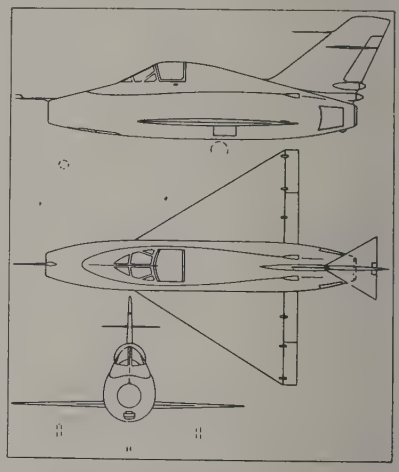
THE NORD 1402 GERFAUT 1.

The Nord Gerfaut 1A was the first high-powered jet delta-wing aircraft to fly in France. It made its first flight on January 15, 1954, and on August 3, 1954, became the first aircraft to exceed Mach 1 in level flight without the use of an afterburner or rocket power. An afterburner has since been fitted.

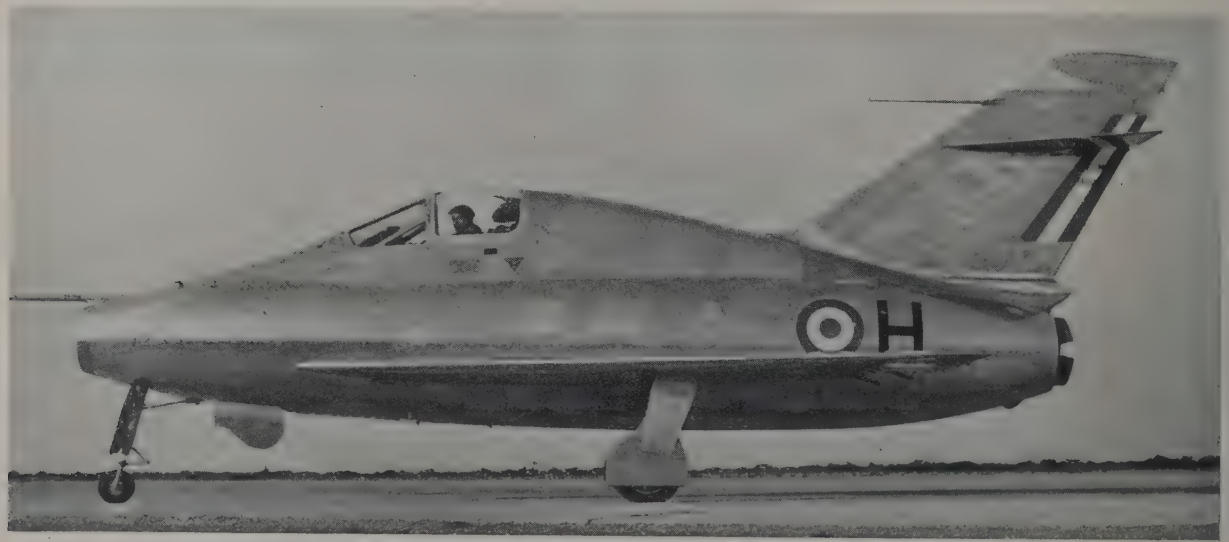
The Gerfaut 1A had a wing span of 6.5 m. (21 ft. 4 in.) and wing area of 19 m.^{2} (204 sq. ft.). The Gerfaut 1B, to which the details below apply, has larger wings, medium-pressure instead of high-pressure tyres and other improvements. This version exceeded the speed of sound in level flight for the first time on February 11, 1955.

TYPE.—Single-seat Research aircraft.

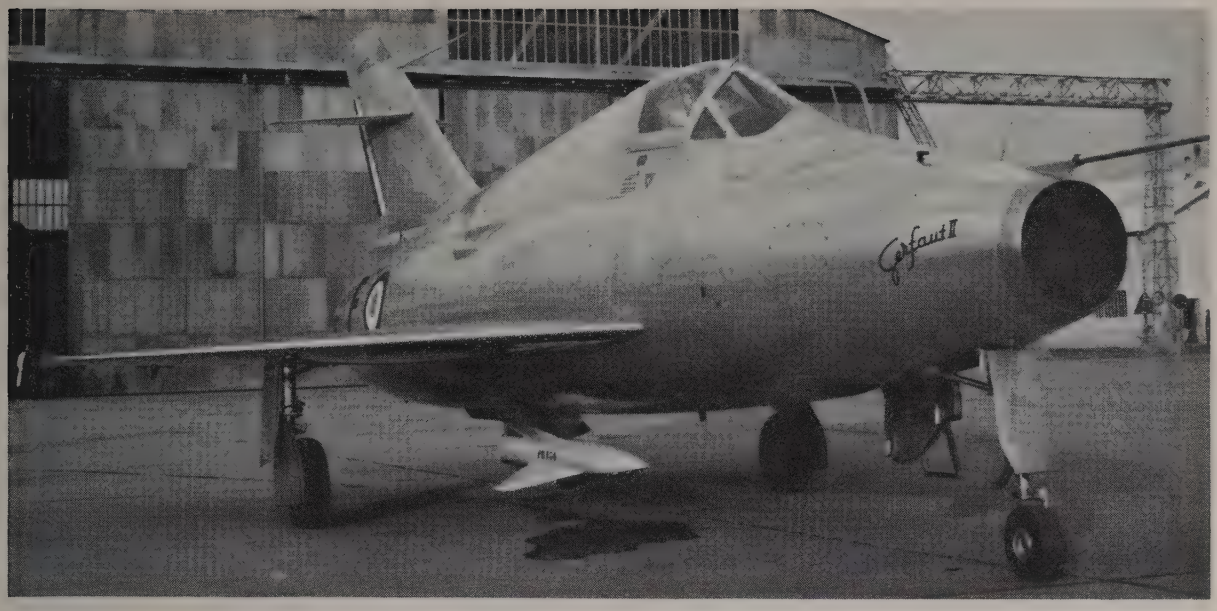
WINGS.—Mid-set cantilever monoplane of delta planform. Aspect ratio 2.16. Leading-edge sweepback 57° 20′. Thickness-chord ratio 5½%. All-metal structure with two main spars and auxiliary leading-edge and trailing-edge spars. Ailerons and elevators inset in trailing edges. Gross wing area 26.2 m.^{2} (282 sq. ft.).



The Nord 1402 Gerfaut 1A.



The Nord 1402 Gerfaut 1A (SNECMA Atar 101 D3 turbojet engine).



The Nord 1405 Gerfaut II (SNECMA Atar 101G turbojet engine with afterburner).

FUSELAGE.—Circular-section all-metal monocoque structure, with pressurised cockpit built on top as a separate structure. Air brakes on each side of rear fuselage, just forward of jet orifice.

TAIL UNIT.—All-metal cantilever monoplane type, with high-mounted variable-incidence tailplane of delta planform. Sweepback on leading-edge of fin 55°. Large tail blister between fin and fuselage, housing a braking parachute. Two small under-tail supplementary fins. Tailplane span 1.85 m. (6 ft. 1 in.).

LANDING GEAR.—Retractable tricycle type of Messier design. Main wheels retract inward into wings. Nose wheel turns through 90° when retracted rearward, to lie flush in fuselage beneath the air inlet duct. Track of main wheels 4.65 m. (15 ft. 3 in.). Wheelbase 3.73 m. (12 ft. 3 in.).

POWER PLANT.—One SNECMA Atar 101D3 developing 2,800 kg. (6,200 lb.) s.t. for take-off. Total fuel capacity 850 litres (187 gallons) in two bag tanks in fuselage superstructure aft of cockpit and four small tanks on each side of the air intake duct under cockpit.

ACCOMMODATION.—Pilot in pressurised cabin built above fuselage as separate superstructure. Knife-edge windscreen. Rearward-hingeing canopy.

DIMENSIONS.—
Span 7.50 m. (24 ft. 7 in.).
Length 9.90 m. (32 ft. 6 in.).
Height 4.10 m. (13 ft. 6 in.).

WEIGHTS.—
Weight empty 3,655 kg. (8,058 lb.).
Weight loaded 4,650 kg. (10,252 lb.).

PERFORMANCE.—
Max. speed at 12,000 m. (39,370 ft.) Mach 1.
Rate of climb at S/L. 4,800 m./min. (15,750 ft./min.).
Ceiling 16,000 m. (52,500 ft.).
Endurance 1 hour.

THE NORD 1405 GERFAUT II.

This development of the Gerfaut design, which made its first flight on April 17, 1956, is powered by a SNECMA Atar 101G turbojet with afterburner. Although similar to the Gerfaut I in some constructional features, 80% of its components have been redesigned. It has flown at supersonic speed on many test flights.

On February 16, 1957, the Gerfaut II established a number of climbing speed records. From a standing start it reached 6,000 m. (19,680 ft.) in 1 min. 17 sec., 9,000 m. (29,520 ft.) in 1 min. 34 sec., 12,000 m. (39,360 ft.) in 2 min. 18 sec. and 15,000 m. (49,200 ft.) in 3 min. 56 sec. On February 28, it set up a further record by climbing to 3,000 m. (9,840 ft.) in 51⅕ seconds. The Gerfaut II has a ceiling of over 16,775 m. (55,000 ft.).

THE NORD 3202.

The 3202, developed from the 3200 and 3201, has been officially adopted as a replacement for the Stampe SV-4 in civilian and military training centres and is now in production. The prototype first flew on April 17, 1957.

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. Dihedral 3° 30′. One-piece metal monospar structure covered with fabric. Trailing-edge flaps inboard of ailerons. Gross wing area 16.50 m.² (177.5 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with metal panels forward and fabric aft.

TAIL UNIT.—Cantilever monoplane type. Metal frames covered with fabric. Tailplane incidence adjustable in flight, fin adjustable on ground only. Automatic tabs in elevator and rudder.

LANDING GEAR.—Fixed type. Cantilever oleo-pneumatic shock-absorber legs. Wheel brakes. Steerable tail-wheel.

POWER PLANT.—One 240 h.p. Potez 4.D-32 four-cylinder in-line inverted air-cooled engine with compressor.

ACCOMMODATION.—Tandem seats, with instructor in rear cockpit, under two-piece sliding canopy. Seats are adjustable for height and take back-type parachutes. Full electrical and VHF radio equipment.

DIMENSIONS.—
Span 9.80 m. (32 ft. 1½ in.).
Length 7.99 m. (26 ft. 2½ in.).
Height 3.120 m. (10 ft. 2¾ in.).

WEIGHTS.—
Weight empty 824 kg. (1,813 lb.).
Crew (2) 166 kg. (365 lb.).
Fuel and oil 144 kg. (317 lb.).
Weight loaded 1,134 kg. (2,495 lb.).

PERFORMANCE.—
Max. speed at S/L 260 km.h. (161 m.p.h.).
Min. speed 83 km.h. (51.5 m.p.h.).
Range 1,000 km. (620 miles).

THE NORD 2501 NORATLAS.

The Nord 2501, which was designed as a military transport for the French Air Force, is also being offered as a civil aircraft suitable for the mixed transport of passengers, bulky freight, vehicles, etc. In the civil version the hold or cabin may be arranged to seat 45 passengers. The cabin is fully sound-proofed, ventilated and heated, while toilet and baggage stowage are provided aft.

A contract for 228 2501 Noratlas military transports is being fulfilled for the French Government. In addition several orders for the civil version have been received.

Under a licence agreement signed in June, 1956, the 2501 Noratlas is being built in Germany by the Nordflug company for the German Air Force. The first



The Nord 2501 Noratlas Transport (two 2040 h.p. SNECMA Hercules engines).



The Nord 2501 Noratlas Transport in the colours of the German Air Force.

25 aircraft were supplied by SNCAN, the remainder (112) being produced by Nordflug.

The following developments of the basic 2501 Noratlas have been mentioned :

Nord 2500-E. One 2502 converted into flying test-bed to study configuration of the 2506 (see below). Wing-tip jet engines removed. First flew on August 9, 1956.

Nord 2502. Standard 2501 with two wing-tip mounted Turbomeca Marboré turbojet engines to provide additional power for take-off and in an emergency. Seven in service with Union Aéromaritime de Transports (U.A.T.).

Nord 2503. Fitted with two 2,500 h.p. Pratt & Whitney R-2800-CB17 engines in place of the standard SNECMA Hercules units. The prototype made its first flight on January 31, 1956.

Nord 2504. Five for French Navy equipped as flying class-rooms for anti-submarine warfare training.

Nord 2506. Development of 2501 with wing-tip mounted Turbomeca Marboré turbojets, slotted flaps, air-brakes, landing gear shock-absorbers which are "deflatable" on ground to facilitate loading, and hydraulically-operated loading doors. Prototype made its first flight in Summer of 1957. Further development cancelled.

Nord 2507. Evolved from 2502 (with wing-tip jets) as a land/sea rescue aircraft. Provision for flight crew of 5. Cabin accommodates 5 look-outs, 1 radar specialist, 1 reserve mechanic and rest facilities for 6 crew members. Sufficient fuel for endurance of 12 hours. Under development.

The specification which follows refers to the standard 2501 military or civil cargo transport.

TYPE.—Twin-engined Military and Civil Transport.

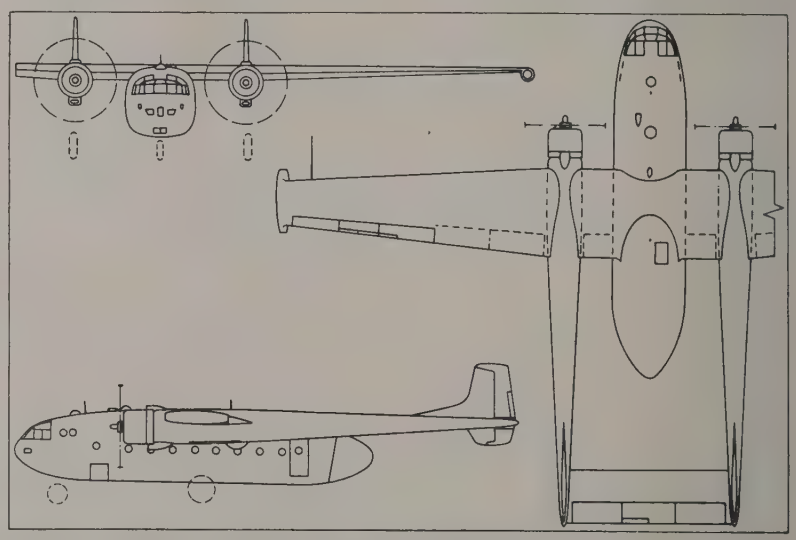
WINGS.—High-wing cantilever monoplane. Aspect ratio 10.5. All-metal structure. Wing in three sections, comprising a centre-section which carries the engine nacelles and tail booms at its extremities and supports the central fuselage; and two outer sections. Ailerons and flaps on outer sections. Wing area 101.2 m.² (1,089 sq. ft.).

FUSELAGE.—The central fuselage, of all-metal construction, accommodates the flight deck and the main hold. Two all-metal booms extending aft from engine nacelles carry the tail-unit. Booms are interchangeable.

TAIL UNIT.—Monoplane type with twin fins and rudders. Fins are integral with tail-booms, tailplane unites the two booms. All-metal structure with metal-covered fixed surfaces and fabric-covered rudders and elevators. Thermal anti-icing for tailplane and fins with single combustion heater on centre-line of tailplane and leading-edge. Later aircraft have extended dorsal fins.

LANDING GEAR.—Retractable tricycle type. Main landing-gear units are interchangeable right and left. Track 7.760 m. (25 ft. 5 in.).

POWER PLANT.—Two 2,040 h.p. SNECMA (Bristol licence) Hercules 738 or 758 (without torquemeters) or, optionally, 739 or 759 (with torque-meters) fourteen-cylinder radial air-cooled engines in interchangeable nacelles. Four-blade Rotol controllable-pitch airscrews, non-reversing with Hercules 738 and 739, reversible with Hercules 758



The Nord 2502 Noratlas Transport.



The Nord 2502 Noratlas Transport. This version has two wingtip-mounted Turbomeca Marboré turbojets.

and 759. Fuel tanks carried in centre-section between spars. Capacity 5,090 litres (1,120 Imp. gallons).

ACCOMMODATION.—Flight deck accommodates pilot and co-pilot side-by-side, radio operator and navigator on left and right behind pilots and engineer with folding seat on rear bulkhead. Main hold has reinforced floor and in military version can be arranged to transport freight, wheeled vehicles, troops, paratroops, stretchers, etc. Dimensions of hold: length 9.90 m. (32 ft. 5 in.), max. height 2.75 m. (9 ft.), max. width 2.40 m. (7 ft. 10 in.), volume 51 m.³ (1,800 cub. ft.). Rear end of fuselage is split vertically and hinged to open to full cross-section of hold for direct loading. Small door forward of wing on port side for access to crew compartment. Main cabin door at aft end of hold on port side. For loading of heavy cargo through rear loading doors a "Tirfor" 2-ton winch can be attached to any loading ring on the central row, a roller at the hold sill completing the installation.

DIMENSIONS.—
Span 32.50 m. (106 ft. 7 in.).
Length 21.962 m. (72 ft.).
Height 6.00 m. (19 ft. 8 in.).

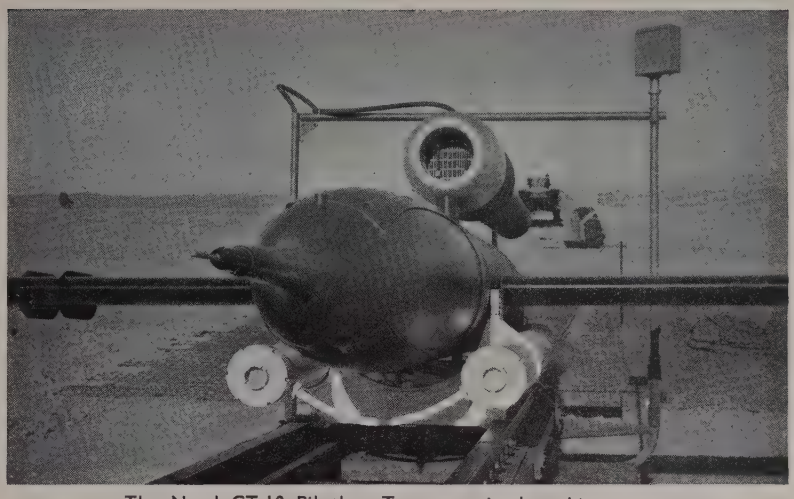
WEIGHTS AND LOADINGS (Civil version—Bristol Hercules engines).—
Weight empty equipped 13,075 kg. (28,765 lb.).
Crew 300 kg. (660 lb.).
Disposable load (less crew) 7,925 kg. (17,435 lb.).
Weight loaded 21,000 kg. (46,200 lb.).
Wing loading 207.5 kg./m.² (42.53 lb./sq. ft.).
Power loading 5.14 kg./h.p. (11.30 lb./h.p.).

PERFORMANCE (at 21,000 kg.=46,200 lb. A.U.W.).—
Max. speed 440 km.h. (273 m.p.h.).
Cruising speed at 1,500 m. (4,920 ft.) 324 km.h. (201 m.p.h.).
Cruising speed at 3,000 m. (9,840 ft.) 335 km.h. (208 m.p.h.).
Rate of climb at S/L. 375 m./min. (1,230 ft./min.).
Rate of climb at 3,000 m. (9,840 ft.) 285 m./min. (935 ft./min.).
Rate of climb on one engine at 1,500 m. (4,920 ft.) 60 m./min. (200 ft./min.).
Service ceiling 7,500 m. (24,600 ft.).
Service ceiling on one engine 2,300 m. (7,545 ft.).
Take-off run 660 m. (720 yds.).
Take-off distance to clear 15 m. (50 ft.) 820 m. (893 yds.).
Landing distance from 15 m. (50 ft.) 790 m. (863 yds.).
Landing run with reversing airscrews 420 m. (459 yds.).

THE NORD CT.10.

The CT.10 is a remotely-controlled pilotless target aircraft which is powered by an Arsenal pulse-jet developing a thrust of 180 kg. (396 lb.). It is now being used by both the French and British Navies.

The body is in three sections, a nose section of mild steel housing the automatic pilot and controlling gear; the centre-section, also of mild steel, supporting the cantilever mid-wing surfaces and housing the fuel tanks; and a tail section of light alloy carrying the twin-finned monoplane tail-unit. The pulse-jet power-unit is supported above the rear



The Nord CT.10 Pilotless Target on its launching ramp.

half of the body by faired vertical struts, the front member enclosing the fuel lines to the engine.

The CT.10 is launched from a ramp which may be either land-based or seaborne. The launching carriage is propelled by two powder rockets and after separation at approximately 200 ft. the carriage is lowered by parachute.

A radio-controlled auto-pilot permits all normal manoeuvres—turns to right and left, climb, descent. The signal for stopping the engine is also given by radio, the landing and recovery procedure being as follows:—after the engine has stopped and speed has been reduced sufficiently, a parachute is released and the remaining fuel is jettisoned through a dump-valve. In the event of a water landing the target floats until recovered. In a descent on land the steel needle nose section digs into the ground.

The Nord CT.10 is successfully used for both anti-aircraft and anti-missile gunnery training. It is also employed for testing instrumentation, etc. for all kinds of air interception operations.

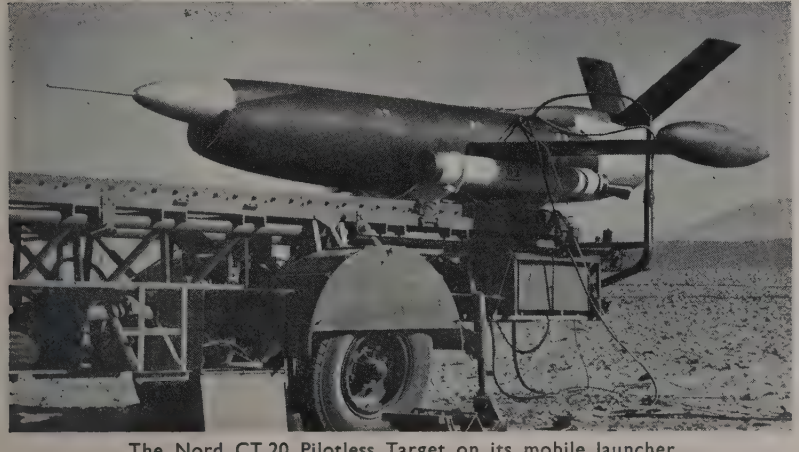
DIMENSIONS.—
Span 4.300 m. (14 ft. 1¼ in.).
Length 6.014 m. (19 ft. 8 in.).
Height 1.092 m. (3 ft. 7 in.).

WEIGHTS.—
Weight loaded 660 kg. (1,452 lb.).

PERFORMANCE.—
Speed at 4,000 m. (13,120 ft.) 460 km.h. (286 m.p.h.).
Climb to 4,000 m. (13,120 ft.) 10 min.
Range 320 km. (200 miles).

THE NORD CT.20.

The CT.20 is a turbojet-powered radio-controlled target with a performance comparable with that of modern service aircraft. It is in series production.



The Nord CT.20 Pilotless Target on its mobile launcher.

The CT.20's launching and control systems are generally similar to those of the CT.10 previously described, although, naturally, engine starting is different. The target is launched from a short mobile ramp 10 m. (32 ft. 9½ in.) long and inclined at an angle of 5 degrees to the horizontal. The launching carriage is powered by two powder rockets and aided by the power of the turbojet engine the CT. 20 has reached a speed of 610 km.h. (555.9 ft./sec.) by the time it has reached its maximum acceleration. The drone then continues to fly under the control of the radio-operator located on the ground or in a "mother" aircraft.

Seven signals can be transmitted, turns to right and left, nose up and down, land, trace smoke and throttle. The turning signal controls bank and the turns are executed without any reverse yaw. The pitch signals act directly on the elevators. When the landing signal is transmitted, the engine is stopped and the brake parachute opens and, at the end of a delay period, the recovery parachute is released. The descent is made in a level attitude and the impact with the ground is cushioned by two air-bags placed fore and aft of the centre-section. In the case of radio-control failure the landing sequence occurs automatically.

TYPE. — Turbojet-powered radio-controlled Drone.

WINGS.—Mid-wing monoplane with medium sweepback. Two half wings have two steel-tube spars and aluminium-alloy ribs and covering. Lateral control spoilers at wing tips. Gross wing area 3.2 m.² (33.34 sq. ft.).

FUSELAGE.—In three main sections. Forward section, of aluminium alloy, contains command-guidance, auto-pilot, batteries and principal recovery parachute. Central section composed of a structural steel tank divided into two parts, one for turbofuel and the other containing chemicals for the tracking smoke. Rear fuselage, of aluminium-alloy, contains the engine and carries the tail-unit. A braking parachute is housed in the cone above the jet nozzle.

TAIL UNIT.—Butterfly type. Of aluminium-alloy construction. Comprises two elevator surfaces simultaneously controlled by a single jack.

POWER PLANT.—One Turbomeca Marboré II turbojet engine (400 kg.=880 lb. s.t.).

DIMENSIONS.—
Span 3.4 m. (11 ft. 2 in.).
Length 5.4 m. (17 ft. 8 in.).

WEIGHT.—
T.O. weight 655 kg. (1,444 lb.).

PERFORMANCE.—
Speed at 10,000 m. (32,800 ft.) 900 km.h. (560 m.p.h.).
Time to 10,000 m. (32,800 ft.) 5 min.
Service ceiling 10,000 m. (32,800 ft.)
T.O. acceleration 10 g.
Mean endurance 45 min.

NORMANDE

SOCIÉTÉ AÉRONAUTIQUE NORMANDE.

HEAD OFFICE AND WORKS: AÉRODROME DE BERNAY.

Director: Lucien Querey.

This company is responsible for production of the Jodel D.117 light aircraft, of which a full description follows.

THE NORMANDE JODEL D.117 GRAND TOURISME.

TYPE.—Two-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane. Single-spar one-piece wing with wide-span centre-section of constant chord and thickness, and two tapering outer portions set at a coarse dihedral angle. Wood structure, fabric covered. Gross wing area 12.7 m.² (136.7 sq. ft.).

FUSELAGE.—Wood structure, fabric covered.

TAIL UNIT.—Cantilever monoplane type. No fin, but rudder faired into top of fuselage. Wood structure, fabric covered.

LANDING GEAR.—Fixed divided type. Cantilever legs with rubber-in-compression springing. Hydraulic brakes. Dunlop 400×100 main wheels. Steerable tail-wheel. Wheel spats.

POWER PLANT.—One 95 h.p. Continental C90-14F four-cylinder horizontally-opposed air-cooled engine driving Regy 1970 two-blade airscrew, with spinner.

ACCOMMODATION.—Two seats side-by-side in enclosed cabin, with tinted Plexiglas canopy. Sound-proofing. Provision for radio.

DIMENSIONS.—
Span 8.22 m. (27 ft. 0 in.).
Height 2.07 m. (6 ft. 9½ in.).

WEIGHT.—
Weight empty 330 kg. (728 lb.).
Weight loaded 585 kg. (1,290 lb.).

PERFORMANCE.—
Max. speed 207 km.h. (129 m.p.h.).
Cruising speed 185-195 km.h. (115-121 m.p.h.).
Stalling speed 50 km.h. (31 m.p.h.).
Rate of climb at S/L 240 m./min. (790 ft./min.).
Ceiling 5,000 m. (16,400 ft.).
Take-off run 120 m. (395 ft.).
Landing run 130 m. (425 ft.).
Max. range at 1,500 m. (5,000 ft.) in still air with 20 min. reserve 1,170 km. (725 miles).

PAYEN

PAYEN-AVIATION.

HEAD OFFICE AND WORKS: 13, QUAI DE L'INDUSTRIE, JUVISY (SEINE-ET-OISE).

Engineer Payen has been engaged in research and development of the delta-wing for the past twenty-five years. He built two delta-wing aircraft before the war, one a light aircraft which flew satisfactorily, and the other a fighter type aircraft which was destroyed during the war.

THE PAYEN Pa. 49/B KATY.

In 1951 M. Payen began the construction of the Pa.49, an experimental single-seat jet propelled tail-less flying-wing with sharp leading edge and moderate trailing-edge sweepback. The wing is fitted with elevators and ailerons. A large triangular fin, the front end of which forms the cockpit fairing, extends over two-thirds of the length of the fuselage. This aircraft made its first flight on January 22, 1954.

After satisfactorily completing its preliminary trials at Melun-Villaroche, the Pa.49 was sent to the Centre d'Essais en Vol, Brétigny, where it completed its first series of tests. It was then fitted with a new Flêchair air-brake system. This takes the form of a split rudder which is effective as a brake throughout the rudder range. Later it is intended to fit the Pa.49 with a retractable landing-gear.

Single and two-seat training versions have been designed, under the designations of Pa.492 and Pa.495 respectively.

The Pa.49 is of all-wood construction and is powered by a Turbomeca Palas turbojet engine (150 kg.=330 lb. s.t.).

DIMENSIONS.—
Span 5.16 m. (16 ft. 11 in.).
Length 5.10 m. (16 ft. 8½ in.).
Height 2.50 m. (8 ft. 2½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 457 kg. (1,005 lb.).
Weight loaded 650 kg. (1,430 lb.).
Wing loading 57 kg./m.² (11.68 lb./sq. ft.).

PERFORMANCE (with fixed L/G.).—
Max. speed 500 km.h. (310 m.p.h.).
Cruising speed 350 km.h. (217 m.p.h.).
Take-off speed 145 km.h. (90 m.p.h.).
Landing speed 100 km.h. (62 m.p.h.).
Initial rate of climb 350 m./min. (1,150 ft./min.).
Ceiling 8,500 m. (27,880 ft.).
Range 450 km. (280 miles).
Take-off run 420 m. (459 yds.).



The Payen Pa.49 Light Delta-wing Research Monoplane.

PIEL

C. PIEL AVIATION.

OFFICE AND WORKS: 284, AVENUE JEAN-JAURÈS, DRANCY (SEINE).

Director: Claude Piel.

M. Claude Piel has designed and built several light aircraft. His latest is the C.P. 30 Emeraude which is being supplied in completed form and in constructional kits for the amateur builder. Details of this aircraft follow.

THE PIEL C.P.30 EMERAUDE.

There are two versions of the Emeraude, as follows:—

C.P.30. Basic version with 65 h.p. Continental engine.

C.P.301. Developed version with 90 h.p. Continental engine.

The Emeraude is one of the types approved for amateur construction in the United Kingdom by the Popular Flying Association.

TYPE.—Two-seat light monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 5.95. Chord 1.50 m. (4 ft. 11 in.) at root, 0.55 m. (1 ft. 9½ in.) at tip. Dihedral 5°. Inner half of each wing is rectangular in plan, outer half elliptical. All-wood single-spar structure with fabric-covering overall. Slotted ailerons. Gross wing area 10.85 m.² (116.7 sq. ft.).

FUSELAGE.—Rectangular wooden structure with domed deck. Two sides are prefabricated Warren-girder structures which are joined together by three main bulkheads and other cross members. Covering is fabric over light longitudinal stringers.

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage. Single-piece single-spar all-wood tailplane. Elevators and rudder are fabric-covered. Trim-tab in starboard elevator.

LANDING GEAR.—Fixed type. Cantilever legs have rubber-in-compression springing. Hydraulic wheel-brakes. Leaf-spring tail skid. Track 2 m. (6 ft. 6 in.).

POWER PLANT.—One 65 h.p. Continental A65 or 90 h.p. Continental four-cylinder horizontally-opposed air-cooled engine. Holleville two-blade fixed-pitch wood airscrew. Fuel tank in fuselage behind fireproof bulkhead.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual controls. Sides of canopy hinge forward for access and exit. Heating and air-conditioning.

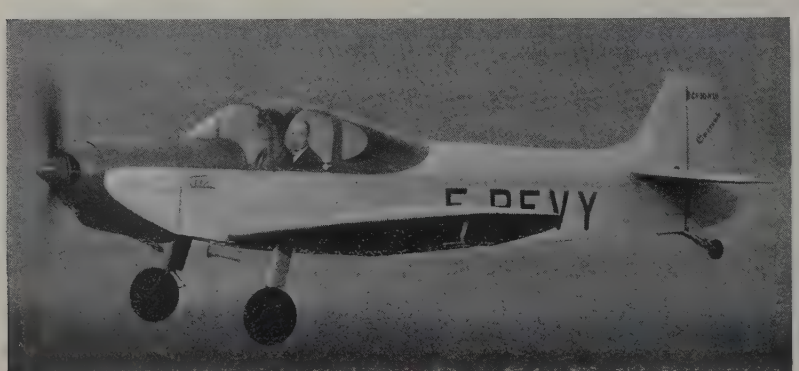
DIMENSIONS.—
Span 8.02 m. (26 ft. 3½ in.).
Length 6.40 m. (20 ft. 11½ in.).

WEIGHTS AND LOADINGS (C.P.30).—
Weight empty 265 kg. (583 lb.).
Weight loaded 500 kg. (1,100 lb.).
Wing loading 46 kg./m.² (9.42 lb./sq. ft.).
Power loading 7.7 kg./h.p. (16.98 lb./h.p.).

WEIGHTS AND LOADINGS (C.P.301).—
Weight empty 344 kg. (758 lb.).
Weight loaded 610 kg. (1,345 lb.).
Wing loading 56 kg./m.² (11.47 lb./sq. ft.).
Power loading 6.4 kg./h.p. (14.11 lb./h.p.).

PERFORMANCE (C.P.30).—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Min. speed 60 km.h. (37.2 m.p.h.).
Rate of climb at S/L 210 m./min. (690 ft./min.).
Service ceiling 4,000 m. (13,125 ft.).
Take-off distance to 15 m. (50 ft.) 120 m. (395 ft.).
Range 800 km. (495 miles).

PERFORMANCE (C.P.301).—
Max. speed 210 km.h. (130 m.p.h.).
Cruising speed 190 km.h. (118 m.p.h.).
Range 1,100 km. (685 miles).



The Piel C.P.30 Emeraude (65 h.p. Continental A65 engine).

POTEZ

ETABLISSEMENTS HENRY POTEZ.

HEAD OFFICE: 46, AVENUE KLEBER, PARIS (XVIe).

WORKS: ARGENTEUIL (S-ET-O).

The original Potez company was formed during the 1914-18 war and up to the nationalisation of the French aircraft industry in 1936 Potez was one of the largest and most productive of French aircraft manufacturers.

In 1936 the Potez aircraft factories at Méaulte (Somme) and Sartrouville (S-et-O) were incorporated in the Société Nationale de Constructions Aéronautiques du Nord, and that at Berre (Bouches-du-Rhône) in the S.N.C.A. de Sud-Est.

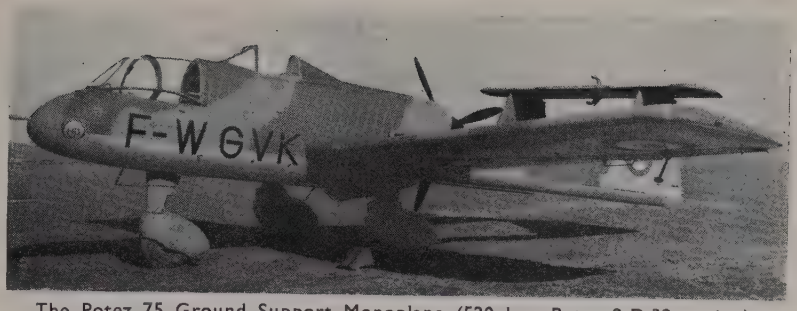
Potez had begun to build aero-engines in 1929 and this branch of the company retained its independence in 1936 under the name of Laboratoire Experimental de Moteurs. After the last war this concern became the Société des Moteurs Potez and in 1953 the name was changed to Société des Avions et Moteurs Henry Potez in order to embrace its widened activities. For details of the aero-engine products of this company see under "Potez" in the Aero-Engine Section.

In 1953 the Société Henry Potez signalised its return to aircraft manufacture, after a lapse of seventeen years, with the appearance of the Potez 75 Army Ground-support monoplane.

THE POTEZ 75.

The Type 75 was designed to meet the requirements of the ground forces as an economical observation, ground support and anti-tank weapon. It is heavily armed and armoured and may be equipped to carry rockets and guided missiles. The prototype flew for the first time on June 10, 1953.

After undergoing extensive trials, during which it logged over 500 flying hours, the Potez 75 was ordered into production for the French Army in 1956, but the contract may be cancelled under the 1957 cut-back in military production.



The Potez 75 Ground Support Monoplane (520 h.p. Potez 8-D.32 engine).

In its developed form, the Potez 75 has an enclosed cockpit for the pilot, who was seated in an open cockpit in the prototype.

TYPE.—Two-seat Ground Support monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Centre-section carries the nacelle and roots for tail booms. Wing sections outboard of centre-section have dihedral of 4°. Gross wing area 23 m.² (247 sq. ft.).

FUSELAGE.—Consists of central all-metal nacelle accommodating crew and pusher engine. All metal tubular tail booms support tail unit.

TAIL UNIT.—One-piece tailplane and inset elevator supported on top of fins which are integral with tail-booms. All-metal structure.

LANDING GEAR.—Fixed nose-wheel type. Knee-action oleo shock-absorbers to all units.

POWER PLANT.—One Potez 8-D.32 eight-cylinder inverted Vee air-cooled engine rated at 415 h.p. at sea level and with 520 h.p. available for take-off. Pusher propeller.

ACCOMMODATION.—Enclosed armoured cockpit in nose for observer/weapon control operator. Aft and above is the pilot's cockpit, also armoured and fitted with a transparent canopy. Nose of nacelle is detachable to permit change of equipment, etc. for various missions.

ARMAMENT (Observation, A.U.W. 2,250 kg. = 4,960 lb.).—Four 7.5 mm. machine-guns, 1,200 rounds ammunition.

ARMAMENT (Ground attack, A.U.W. 2,500 kg. = 5,512 lb.).—Four 7.5 mm. machine-guns, 1,200 rounds ammunition, and underwing armament of 28 × 68 mm. rockets, or 8 × 7.5 mm. machine-guns and 2,400 rounds, or 4 × 50 kg. bombs, or two SS.11 air-to-ground guided missiles.

ARMAMENT (Ferrying, A.U.W. 2,530 kg. = 5,578 lb.).—Four 7.5 mm. machine-guns and fuel for 1,400 km. (870 miles). No ammunition.

DIMENSIONS.—
Span 13.10 m. (42 ft. 11 in.).
Length 9.16 m. (29 ft. 1 in.).
Height 2.70 m. (8 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty (equipped) 1,765 kg. (3,891 lb.).
Disposable load 485-765 kg. (1,069-1,687 lb.).
Weight loaded 2,250-2,530 kg. (4,960-5,578 lb.).

PERFORMANCE (Ground attack configuration).—
Max. speed 275 km.h. (170.5 m.p.h.).
Cruising speed (75% power) 228 km.h. (142 m.p.h.).
Take-off speed 110 km.h. (68.2 m.p.h.).
Landing speed 110 km.h. (68.2 m.p.h.).
Initial rate of climb 405 m./min. (1,330 ft./min.).
Take-off run 220 m. (720 ft.).
Landing run 200 m. (655 ft.).
Take-off distance to 15 m. (50 ft.) 420 m. (1,380 ft.).
Landing distance from 15 m. (50 ft.) 360 m. (1,180 ft.).
Range 600 km. (373 miles).
Max. range (ferrying) 1,400 km. (870 miles).

SIPA

SOCIÉTÉ INDUSTRIELLE POUR L'AÉRONAUTIQUE.

HEAD OFFICE: 178, AVENUE DE NEUILLY, NEUILLY (SEINE).

WORKS: 40, RUE J.-J. ROUSSEAU, SURESNES (SEINE).

President: M. Harrisson.

General Manager: M. Arm.

Technical Manager: M. Gardan.

This Company was formed in 1938. Until 1940 it was engaged in the manufacture of parts and components for Lioré-et-Olivier, Amiot and Morane aircraft and the overhaul of Mureaux aircraft for the French Air Ministry.

Its first post-war production was the S.10, the French version of the Arado Ar 396. This was followed by the S.11 and S.111, which are modified versions fitted with the SNECMA 12S (the French-built Argus As 411), and the S.12 which is entirely of metal construction. The company has since produced fifty S.121 trainers, this model differing in only minor details from the S.12. This last-mentioned order brought the total number of aircraft in this series (S.10, S.11, S.111, S.12 and S.121) which have been built for the French Air Force to 234. SIPA was later engaged in converting the earlier S.11's up to S.121 standard.

The SIPA 901 was selected by the Government for use in the schools of the Service de l'Aviation Légère et Sportive and a production order for 100 was completed in 1952.

The latest SIPA products are the SIPA 1000 Coccinelle low-cost light monoplane, and the SIPA 1100, a light twin-engined ground support aircraft, the prototype of which was due to fly before the end of 1957. A pre-production order for ten is in hand.

In addition, SIPA is engaged in sub-contract work, including the manufacture of fuselages for the Max Holste Broussard.

THE SIPA 1100.

Designed as a simple, rugged general purposes aircraft for operation from small unprepared airstrips in colonial territories, the SIPA 1100 will be a shoulder-wing monoplane with retractable landing gear and will be powered by two 610 h.p. Pratt & Whitney R-1340 engines. The cockpit, adaptable for various duties, will be characterised by a good all-round field of vision.

No further details are yet available.

THE SIPA 1000 COCCINELLE.

The SIPA 1000 is a two-seat light monoplane, the outstanding characteristics of which are simplicity and cheapness of manufacture and operation. The design was begun on April 4, 1955, and the prototype first flew on June 11, 1955.

TYPE.—Two-seat light monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal framework covered with fabric. Each half wing quickly detachable from fuselage. Single-slotted flaps and single-slotted interchangeable ailerons. Gross wing area 12.8 m.² (137.8 sq. ft.).

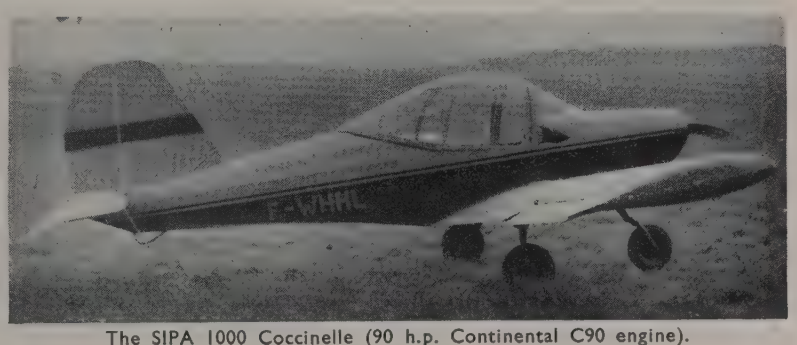
FUSELAGE.—Welded steel-tube structure covered forward with detachable light metal panels and aft with fabric.

TAIL UNIT.—Cantilever monoplane type. Welded steel-tube frames covered with fabric. Automatic elevator tab linked with flap operating mechanism.

LANDING GEAR.—Fixed nose-wheel type. Low-pressure oleo-pneumatic shock-absorbers. Automobile-type wheel-brakes. Parking brake. Steerable nose-wheel. Wheelbase 1.33 m. (4 ft. 4 in.). Track 1.90 m. (6 ft. 3 in.).

POWER PLANT.—One 90 h.p. Continental C90-8F or 12F four-cylinder horizontally-opposed air-cooled engine (8F engines without electric starter, 12F engines have electric starter and generator). Two-blade fixed-pitch wood airscrew. Quickly-removable two-piece cowling. Fuel capacity 78 litres (17 Imp. gallons).

ACCOMMODATION.—Cockpit seats two side-by



The SIPA 1000 Coccinelle (90 h.p. Continental C90 engine).

side with dual controls. Sliding 360° vision canopy. Sound-proofing and air-conditioning. All controls accessible to both occupants.

DIMENSIONS.—
Span 9 m. (29 ft. 6½ in.).
Length 5.45 m. (17 ft. 10½ in.).
Height 2.20 m. (7 ft. 2½ in.).

WEIGHTS.—
Weight empty 335 kg. (737 lb.).
Weight loaded 620 kg. (1,367 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Landing speed (without flaps) 65 km.h. (40.5 m.p.h.).
Landing speed (with flaps) 50 km.h. (31 m.p.h.).
Take-off run 80 m. (263 ft.).
Take-off distance to clear 20 m. (66 ft.) 250 m. (273 yds.).
Landing run 40 m. (33 yds.).
Range 700 km. (435 miles).

SNECMA

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION.

HEAD OFFICE : 150 BOULEVARD HAUSSMANN, PARIS (XIIIe).

WORKS : PARIS (BOULEVARD KELLERMANN), BILLANCOURT (SEINE), VILLAROCHE (SEINE-ET-MARNE), SURESNES (SEINE) AND GENNEVILLIERS (SEINE).

President and Director-General : Henri Desbruères.

Administrative Director : M. Depallens.

Technical Director : H. Oestrich.

Director-Controller : Marcel Richer.

Commercial Director : André Esperet.

Director of External Relations : Maurice Roudil.

Director of Atomic Division : Raymond Marchal.

Personnel Manager : M. Dugue MacCarthy.

In addition to its main activities in the design, manufacture and repair of aero-engines, as described in the "Gas-Turbine" and "Piston Engine" sections of this work, SNECMA is engaged on research into methods of vertical take-off for aircraft.

The company has acquired the European rights in Professor von Zborowski's patents for the annular wing, or Coleopter, type of aircraft. It has also developed the "Flying Atar" VTOL research vehicle, of which details are given hereafter.

THE SNECMA "ATAR VOLANT."

Following initial research and development work conducted during 1952 and 1953, SNECMA carried out, in 1954, tethered flight tests with a remotely-controlled VTOL model powered by a 45 kg. (100 lb.) s.t. SNECMA pulse-jet engine. These tests were made to investigate control and stability problems, and in the following year vertical rig tests of a full-scale Atar turbojet oil system and gimbal-rig tests of jet-deflection and stabilization devices were made.



The SNECMA C.400 P-1 under its test gantry (left) and the C.400 P-2 in free flight.

The construction of the full-scale Atar Volant was begun in 1955, and since then two versions have been built and a third is under construction. These are as follows :—

C.400 P-1. Pilotless remotely-controlled research vehicle comprising an Atar 101 DV turbojet (2,900 kg. = 6,393 lb. s.t.) mounted vertically on a tubular four-wheel undercarriage, with fuel tanks and gyroscopic control. Tested on gyroscopic rig in 1955. First tethered flight test in specially-built gantry on September 22, 1956. More than 250 flights made subsequently to study stabilization and the effect of wind.



The SNECMA C.400 P-1 pilotless (left) and C.400 P-2 piloted "Atar Volant" VTOL Research vehicles.

C.400 P-2. Basically similar to C.400 P-1, but with platform above air intake carrying ejection seat for pilot, instrument panel and controls. Directional control by jet-deviation, using jets of air bled from compressor to deflect main efflux. Lateral turning by air jets on landing gear struts. Annular tanks containing 500 kg. (1,100 lb.) of fuel surround engine compressor, giving endurance of over four minutes. Weight at take-off 2,600 kg. (5,730 lb.). Tethered tests in the gantry began on April 8, 1957. First free flight on May 14, 1957.

C.400 P-3. Development of C.400 P-2 built around Atar 101E turbojet (3,500 kg. = 7,700 lb. s.t.) and with tilting ejection seat inside enclosed cockpit. Under construction.

As a further stage in the programme, the Nord company is building an airframe for a prototype Atar-powered Coleopter in its Chatillon-sous-Bagneux works.

SUD

SUD-AVIATION, SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES.

HEAD OFFICE: 37, BOULEVARD DE MONTMORENCY, PARIS (16e).

WORKS: TOULOUSE, MARIGNANE, COURBEVOIE, SAINT NAZAIRE, BOUGUENAIS, LA COURNEUVE, ROCHEFORT, MELUN VILLAROCHE, CANNES AND SURESNES.

President-Director General: Georges Hereil.

Sud-Aviation was formed on March 1, 1957, by amalgamation of the two companies Ouest-Aviation and Sud-Est Aviation which, until September 1, 1956, had been known respectively as the Société Nationale de Constructions Aéronautiques du Sud-Ouest (S.N.C.A.S.O.) and the Société Nationale de Constructions Aéronautiques du Sud-Est (S.N.C.A.S.E.).

Formed in 1936 under the Nationalisation Laws, the S.N.C.A.S.O. company comprised initially factories which belonged formerly to the Marcel Bloch, Louis Blériot and Lioré-Olivier companies. In 1941, the S.N.C.A. de l'Ouest was merged into the S.N.C.A.S.O., bringing in factories of the former Loire-Nieuport company.

In the same way, the S.N.C.A.S.E. company included initially factories formerly owned by Lioré-Olivier; and in 1941 the S.N.C.A. du Midi was merged into the S.N.C.A.S.E., bringing in the factories of the former Dewoitine company.

Ouest-Aviation and Sud-Est Aviation employed together a total of 22,000 persons at the end of 1956 and had a covered area exceeding 5,380,000 sq. ft.

Recent and current Sud-Aviation products include the S.E.210 Caravelle medium-range twin-jet airliner, which is in production for Air France and SAS; the S.E.5000 Baroudeur tactical support fighter; the S.E.212 Durandal supersonic lightweight interceptor; the S.O.9050 Trident II supersonic lightweight mixed power interceptor, of which a pre-production batch is under construction; the S.O.4050 Vautour twin-jet monoplane for tactical support, bombing and all-weather fighting, which is in quantity production for the French Air Force; and the S.E.3130 Alouette II and S.O.1221 Djinn helicopters, both of which are in major production for the French Army, Air Force and Navy and for civilian customers. All of these aircraft are described and illustrated hereafter.

Under development are the S.E.116 Fonceur twin-engined light tactical support aircraft and two new versions of the Alouette known as the Gouverneur and S.E.3140, of which brief details are given below.

In addition, the company is engaged on the study, development and production of missiles and target drones, and is responsible for building the ejector seats for all French jet-powered aircraft.

Besides production of its own designs, Sud-Aviation is building the Aquilon, a French-licence version of the de Havilland Sea Venom, and is participating in the production of the Dassault Mystère series of fighters and the Fouga Magister twin-jet trainer. The company also has an agreement with Republic Aviation International covering the manufacture of spare parts for the F-84F Thunderstreak and is engaged on repair and overhaul of the F-84 Thunderjet and Lockheed T-33 for the French Air Force. It is responsible for servicing Vertol H-21 helicopters used in France and is assembling U.S.-built Sikorsky S-58 helicopters.

Sud-Aviation also supervises the work of subsidiaries such as the S.F.E.R.M.A. company, which has added to its former activities the production of aircraft accessories for the Vautour, and the Saint Chamond-Granat company, which includes among its activities the production of special instruments designed for Sud-Aviation products.

THE S.E.210 CARAVELLE.

Two prototypes of the Caravelle medium-range twin-jet airliner have been built to the order of the Secretariat d'Etat a l'Air. The first made its maiden flight on May 27, 1955, and the second on May 6, 1956. The two are generally similar, the most important modification being deletion of the wing leading-edge slats on the second prototype.

By the end of 1956, the first prototype Caravelle had completed 1,053 flying hours, including 400 hours in four months as a scheduled freighter on Air France routes in Europe and North Africa. The second prototype made a demonstration tour of North America in the spring and early summer of 1957.

An order for 12 Caravelles, with an option on 12 more, was signed by Air France on February 3, 1956. SAS have ordered six, with an option on 19 more. Production aircraft, to which the following details apply, are scheduled to enter service in 1958.

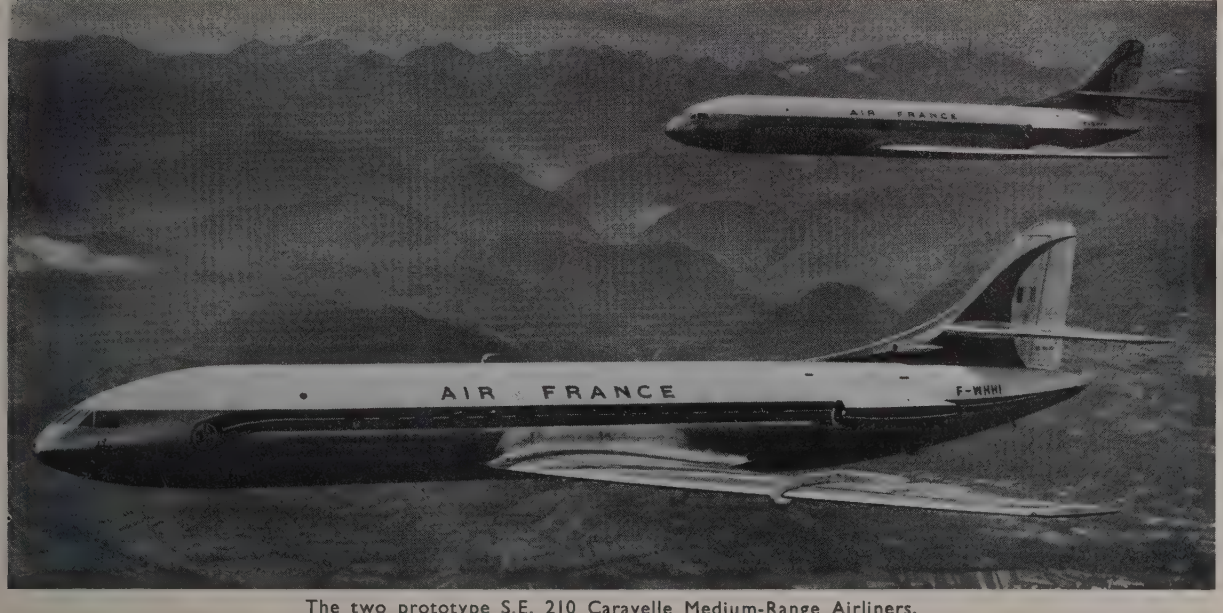
TYPE.—Twin-jet Medium-Range Airliner.

WINGS.—Low-wing cantilever monoplane. NACA 65$_1$212 wing section with cambered leading-edge. Aspect ratio 8.02. Sweepback 20° at 25% of chord. Dihedral 3°. Incidence at root 2°. Chord 6.33 m. (20 ft. 9 in.) at root, 2.23 m. (7 ft. 4 in.) at tip. Wing in two sections joined on fuselage centre-line. All-metal structure. Two-piece all-metal ailerons on each wing. Slotted trailing-edge flaps. Air brakes on upper and lower surfaces ahead of flaps. Thermal de-icing. Total area of ailerons 7.84 m.² (84.4 sq. ft.). Total area of flaps 24.70 m.² (265.8 sq. ft.). Gross wing area 146.7 m.² (1,579 sq. ft.).

FUSELAGE.—Circular section all-metal monocoque structure. Overall length 32.01 m. (104 ft. 10 in.). Maximum diameter 3.20 m. (10 ft. 6 in.). Length of pressurised section 25.96 m. (85 ft.).

TAIL UNIT.—Cantilever monoplane type. Sweepback of tailplane 30° at 25% of chord. All-metal structure. Thermal de-icing. Areas: fin 10 m.² (107.6 sq. ft.), rudder 5.5 m.² (59.2 sq. ft.), tailplane 21.55 m.² (232 sq. ft.), elevators 6.45 m.² (69.4 sq. ft.). Tailplane span 10.6 m. (34 ft. 9 in.).

LANDING GEAR.—Retractable nose-wheel type. Hispano shock-absorbers. Twin nose-wheel unit with Hispano 503.851 wheels. Each main unit has a four-wheel bogie with Hispano 241.642 wheels. Hydraulic retraction. Maxaret anti-skid brakes on main wheels. Track of main units (between centre-line of shock struts) 5.21 m. (17 ft.). Wheelbase 11.79 m. (38 ft. 7 in.).



The two prototype S.E. 210 Caravelle Medium-Range Airliners.



The first prototype S.E. 210 Caravelle Airliner (two Rolls-Royce Avon RA.29 turbojet engines).

POWER PLANT.—Aircraft of the initial series will have two Rolls-Royce Avon RA.29 axial-flow turbojet engines (4,762 kg.= 10,500 lb. s.t. each) mounted in nacelles one on each side of the rear fuselage just ahead of tail unit. Aircraft of the second series (beginning in 1960) will have two Rolls-Royce Avon RA.29 turbojets of 5,217 kg. (11,500 lb.) s.t. each in a similar installation. Integral wing fuel tanks. Total fuel capacity 18,500 litres (4,080 Imp. gallons).

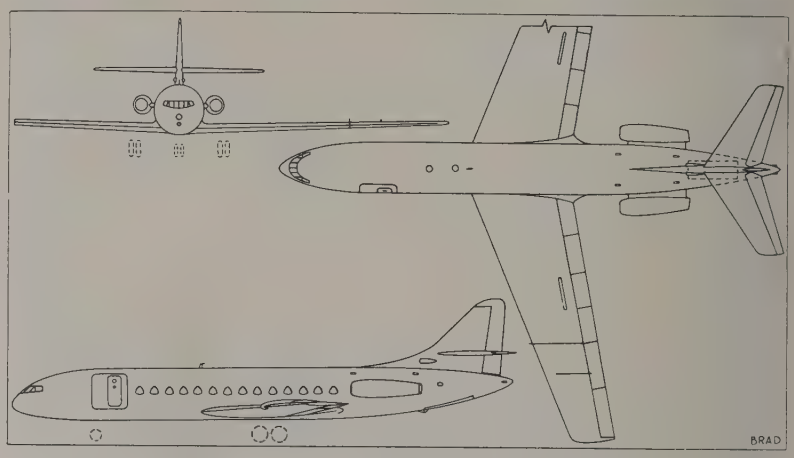
ACCOMMODATION.—Crew compartment in nose. Main cabin with normal accommodation for 80 passengers. Entire accommodation pressurised to maintain a cabin atmosphere of 2,500 m. (11,480 ft.) to a height of 12,000 m. (39,350 ft.). Main access to cabin aft through door under rear fuselage with hydraulically-operated integral steps. Steps serve as tail support when lowered. Cabin floor 2.10 m. (6 ft. 10 in.) above ground level. Two toilets, coat rooms and light baggage racks aft of cabin. Two galleys, one forward and one aft of cabin.

DIMENSIONS.—
Span 34.30 m. (112 ft. 6 in.).
Length 32.01 m. (104 ft. 10 in.).
Height 8.69 m. (28 ft. 6 in.).

WEIGHTS (with 4,762 kg.=10,500 lb. s.t. engines).—
Weight empty equipped 23,200 kg. (51,000 lb.).
Max. design take-off weight 41,000 kg. (90,400 lb.).
Max. landing weight 39,000 kg. (86,000 lb.).
Max. zero fuel weight 33,000 kg. (72,750 lb.).

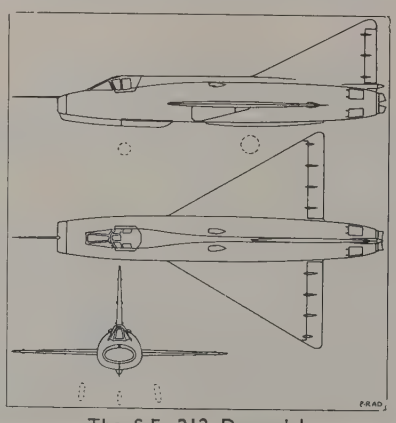
WEIGHTS (with 5,217 kg.=11,500 lb. s.t. engines).—
Weight empty equipped 23,200 kg. (51,000 lb.).
Max. design take-off weight 43,000 kg. (94,800 lb.).
Max. landing weight 41,000 kg. (90,400 lb.).
Max. zero fuel weight 33,000 kg. (72,750 lb.).

PERFORMANCE (with 4,762 kg.=10,500 lb. s.t. engines).—
Cruising speed at 9,300-10,970 m. (30,500-36,000 ft.) 740 km.h. (460 m.p.h.).
Take-off field length at 41,000 kg.=90,400 lb. A.U.W. at S/L with one engine out 1,680 m. (5,500 ft.).
Landing distance from 15 m. (50 ft.) at 39,000 kg.=86,000 lb. A.U.W. at S/L. 975 m. (3,200 ft.).



The S.E. 210 Caravelle Medium-Range Airliner.

PERFORMANCE (with 5,217 kg.=11,500 lb. s.t. engines).—
Cruising speed 820 km.h. (510 m.p.h.).
Take-off field length at 43,000 kg.=94,800 lb. A.U.W. at S/L. with one engine out 1,680 m. (5,500 ft.).
Landing distance from 15 m. (50 ft.) at 41,000 kg.=90,400 lb. A.U.W. at S/L. 1,000 m. (3,300 ft.).



The S.E. 212 Durandal.



The S.E. 212 Durandal (SNECMA Atar turbojet engine with afterburner).

THE S.E. 212 DURANDAL.

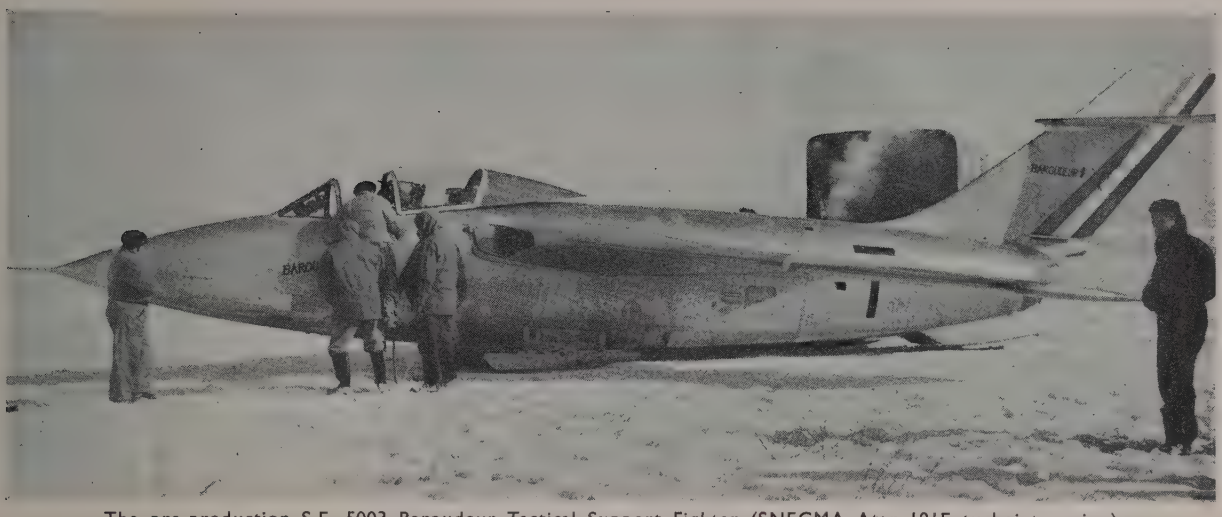
The Durandal is a single-seat delta-wing lightweight interceptor powered by a SNECMA Atar G-3 turbojet, developing 4,500 kg. (9,920 lb.) s.t. with afterburner, and an SEPR 65 liquid-propellent rocket-motor of 825 kg. (1,819 lb.) s.t. The rocket-motor is installed complete with its fuel tanks and pumps in a detachable fairing under the fuselage and is used to boost acceleration to supersonic speeds at high altitude.

Because the rocket pack is easily removable, the propellent tanks can be recharged away from the aircraft, which simplifies handling of the propellents. Alternatively, an external kerosene fuel tank can be fitted in place of the rocket pack, to supplement the internal fuel tankage in the wings and fuselage.

The Durandal has wings of approximately 5% thickness-chord ratio, knife-edge wind-screen, a massive fin and rudder and an unusual under-fairing blade under its nose. The nose-wheel of its landing-gear retracts rearward and the main wheels retract forward, all units being stowed inside the fuselage in flight.

Normal armament comprises a Matra 510 air-to-air guided missile carried under the rocket pack, but provision is made also for conventional armament.

The first prototype flew for the first time on April 20, 1956, powered only by the Atar turbojet with afterburner, and had almost completed its test programme at the time of going to press. It has proved capable of speeds in level flight corresponding to a Mach number of more than 1.5 and has been rolled at Mach numbers above 1.2 with and without its air-to-air missile. It needs a landing and



The pre-production S.E. 5003 Baroudeur Tactical Support Fighter (SNECMA Atar 101E turbojet engine).

take-off run of approximately 700 m. (2,300 ft.).

A projected developed version, known as the Durandal IV, will have a SNECMA Atar 9 turbojet, giving 6,060 kg. (13,360 lb.) s.t. with afterburner.

DIMENSIONS (approx.).—
Span 6.5 m. (21 ft. 4 in.).
Length 11.0 m. (36 ft. 1 in.).
Height 4.0 m. (13 ft. 1½ in.).
Wing area 22 m.² (236 sq. ft.).

WEIGHTS AND LOADINGS (approx.).—
Weight empty 2,720 kg. (6,000 lb.).
Weight loaded 4,050 kg. (8,930 lb.).
Wing loading 184 kg./m.² (37.7 lb./sq. ft.).
Power loading 0.79 kg./kg. s.t. (0.79 lb./lb. s.t.).

PERFORMANCE.—
Max. speed at 12,000 m. (39,370 ft.) 1,700 km.h. (1,055 m.p.h.).
Rate of climb at S/L 12,000 m./min. (39,370 ft./min.).
Rate of climb at 11,000 m. (36,000 ft.) 8,400 m./min. (27,560 ft./min.).
Service ceiling 17,000 m. (55,775 ft.).

THE S.E.5000 BAROUDEUR.

The S.E.5000 is a single-seat tactical support jet fighter which has been designed to operate independently of airfields with long runways. It can take off either on a separate three-wheeled trolley or on the small skids on which it always lands.

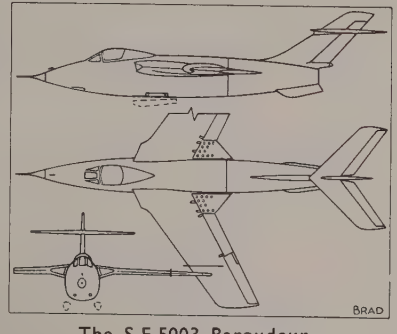
The take-off trolley, of welded steel tubing, reproduces the layout of a nose-wheel landing-gear. All wheels have low-pressure tyres and are sprung by rubber blocks. The rear wheels are fitted with brakes which are operated by the pilot while the aircraft is on the trolley, or automatically after the aircraft has taken off. The trolley can be fitted with six rockets, two or four being used for take-off according to the type of terrain, and two are for emergency use.

The aircraft is mounted on its take-off trolley by a winch-fitted Jeep, which tows the trolley into position and then hauls the aircraft into place. The operation can be completed in under two minutes.

The built-in landing gear of the S.E. 5000 consists of three retractable skids, two main forward and one auxiliary aft. A special skid brake reduces the landing run and permits ground manoeuvrability comparable to that of a conventional wheeled aircraft.

The first prototype S.E.5000 made its first flight on August 1, 1953. A second prototype flew for the first time on May 12, 1954, and on July 17 of the same year this aircraft exceeded Mach 1 in a dive. It has since demonstrated its ability to operate from uncultivated fields, sand and pebble beaches and muddy, snow-covered or frozen ground.

Three pre-production aircraft which carry the designation S.E. 5003 have been



The S.E.5003 Baroudeur.

built for service trials. They are fitted with the Atar 101 E-4 engine (3,700 kg. = 8,160 lb. s.t.) and can carry two 1,000 kg. (2,200 lb.) bombs under their wings.

TYPE.—Single-seat Jet Fighter.

WINGS.—Shoulder-wing cantilever monoplane. Leading-edge sweepback 38°. All-metal structure made up of one main spar, two auxiliary spars, closely spaced ribs and smooth flush-riveted skin. Leading-edge slats. Trailing-edge flaps inboard of ailerons, the latter being operated by Jacotet hydraulic boost control units.

FUSELAGE.—In two sections, each made up of a keel member, a series of bulkheads and stiffened skin panels. Rear section detachable for access to engine.

TAIL UNIT.—Cantilever monoplane type with one-piece tailplane mounted near top of fin. Leading-edge sweepback of fin 55°, of tailplane 42°. Tailplane adjustable by two-speed electric jack. Elevators and rudder actuated by Jacotet hydraulic boosters. Electrically-operated trim-tab in rudder.

LANDING GEAR.—Retractable skids for take-off and landing, two main skids forward and one under tail. Skids are of magnesium-alloy with replaceable mild steel shoes. Skids are sprung by rubber blocks in both torsion and compression. Alternative take-off by independent trolley which has already been described in introduction.

POWER PLANT.—One SNECMA Atar 101 E-4 axial-flow turbojet engine in fuselage with air inlets in wing roots. Main fuel tanks of self-sealing type in fuselage. Provision for underwing auxiliary or ferrying tanks.

ACCOMMODATION.—Pressurised and armoured cockpit forward of wings with sliding and jettisonable canopy. Sud-Aviation ejection seat.

DIMENSIONS.—
Span 10 m. (32 ft. 9½ in.).
Length 13.49 m. (44 ft. 3 in.).
Height (on trolley) 3.600 m. (11 ft. 9½ in.).
Height (on skids) 3.04 m. (10 ft.).

WEIGHTS.—
Weight empty 4,654 kg. (10,260 lb.).
Weight loaded 6,671 kg. (14,710 lb.).

PERFORMANCE.—
Max. speed at S/L. 1,195 km.h. (742 m.p.h.).
Max. speed at 11,000 m. (36,000 ft.) 1,090 km.h. (677 m.p.h.).
Landing speed 170 km.h. (106 m.p.h.).
Max. rate of climb 4,830 m./min.. (15,846 ft./min.).
Time to 9,150 m. (30,000 ft.) 1.9 min.
Service ceiling 16,750 m. (55,000 ft.).
Take-off distance to 15 m. (50 ft.) 500 m. (1,640 ft.).
Landing distance 240 m. (790 ft.).

THE S.E. X.116 FONCEUR

The Fonceur is a twin-engined low-wing tactical support monoplane with single fin and rudder and tricycle landing gear, designed to offer exceptional fire-power and a wide speed range. Two prototypes have been ordered. Each will be powered initially by two 800 h.p. piston-engines, to be replaced eventually by two Turbomeca Bastan turboprops.

A light transport version of the Fonceur will also be developed.

THE S.E. AQUILON.

The Aquilon is the French licence version of the de Havilland Sea Venom which is being produced for the French Navy.

The following versions of the Aquilon have been built :—

Aquilon Mk. 20. Prototype similar to Sea Venom Mk. 20. Has 15 ft./sec. (4.57 m./sec.) landing gear, hinged hood-type canopy and fixed seats.

Aquilon Mk. 201. Advanced prototype. One only. This aircraft underwent catapulting and arrester-gear trials at R.A.E., Farnborough in 1954. Similar to Mk. 202 but with 15 ft./sec. (4.57 m./sec.) landing gear.

Aquilon Mk. 202. Initial production version, the first of which flew on March 24, 1954. Has 18 ft./sec. (5.48 m./sec.) landing gear as on Sea Venom Mk. 21, sliding canopy and Sud-Aviation ejector seats.

Aquilon Mk. 203. Similar to Mk. 202 but is a single-seat version. Is also equipped with more advanced type of radar.

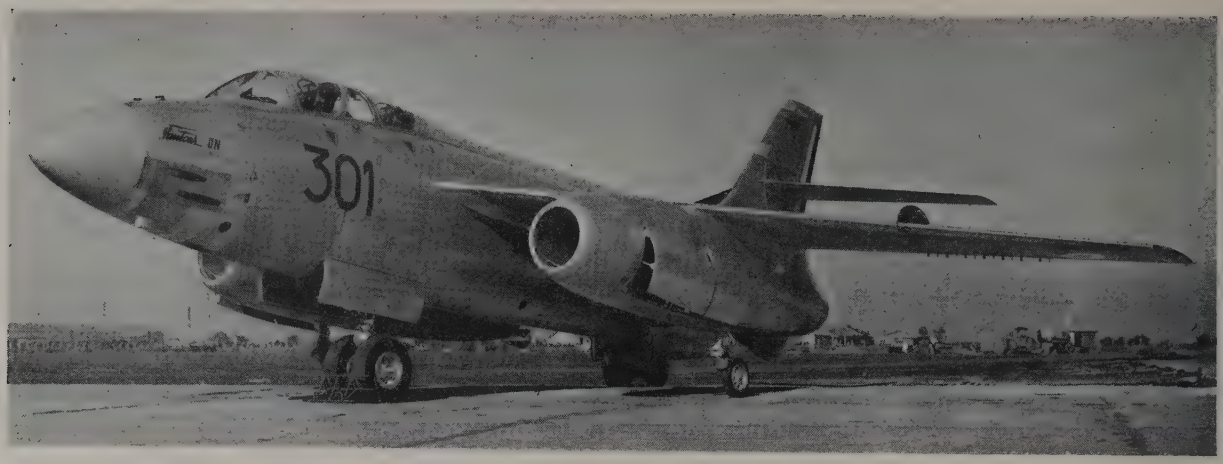
Aquilon Mk. 204. Two-seat unarmed trainer version of the Mk. 203. Has 15 ft./sec. (4.57 m./sec.) landing gear, sliding canopy and ejection seats.

Two production orders for a total of 50 of the Mk. 202 two-seat carrier-borne all-weather fighters were completed by the Spring of 1956, when work started on a further contract for 40 of the Mk. 203 single-seat version.

All versions are powered by a Ghost 48 Mk. 1 turbojet engine (2,200 kg. = 4,840 lb. s.t.).

Fixed armament consists of four 20 mm. cannon plus eight rockets. In addition, a Matra 5103 air-to-air missile can be carried under each wing.

DIMENSIONS.—
Span (over tip-tanks) 13.071 m. (42 ft. 10½ in.).



The S.O. 4050 Vautour N Two-seat All-weather Fighter (two SNECMA Atar 101E turbojet engines).

Width folded 7.02 m. (23 ft.).
Length 11.137 m. (36 ft. 6 in.).
Height 2.31 m. (7 ft. 7 in.).
Height (with wings folded) 3.00 m. (9 ft. 10 in.).
Gross wing area 26.0 m.² (280 sq. ft.).

PERFORMANCE.—
Max. speed 960 km.h. (600 m.p.h.).
Service ceiling 15,000 m. (49,200 ft.).

THE S.O. 4050 VAUTOUR.

The S.O. 4050 Vautour is a swept-wing twin jet monoplane which has been designed for tactical support, bombing and all-weather fighting.

The use of external engine pods below the wings permits the installation of various types of turbojet engines with ratings of up to 4,500 kg. (10,000 lb.) s.t.

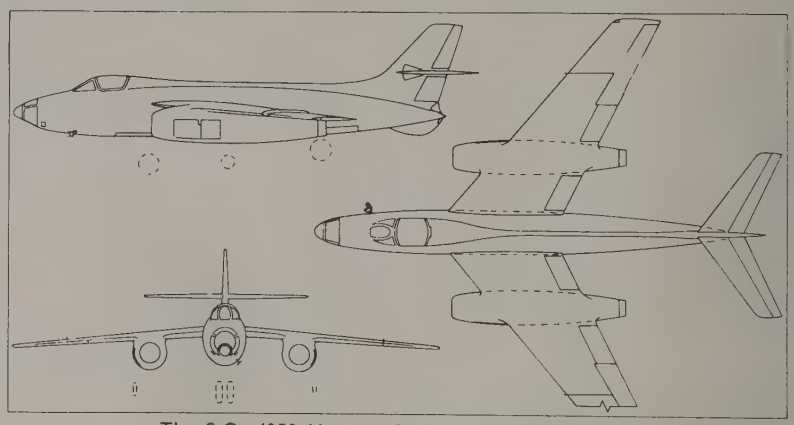
Metal-to-metal bonding technique, widely used in the construction of the Vautour, is applied to sections of the wing, tailplane, rudder, bomb-bay doors, bomb-hoist, etc.

The first prototype, which flew on October 16, 1952, exceeded Mach 1 in a slight dive at altitude during its early trials and was the first French twin-jet aircraft to do so.

Special gear enables the tactical support and bomber versions to drop their bombs at transonic speeds from all altitudes.

With normal load the Vautour can operate from runways measuring less than 800 m. (2,650 ft.) in length. For landing a ribbon-type braking parachute may be used to shorten the run.

The original order for three prototypes was followed in 1953 by an order from the French Government for six pre-production Vautours, comprising one bomber, two tactical support aircraft and three all-weather fighters. Various engines were fitted in these first nine aircraft, including several marks of SNECMA Atar, Armstrong Siddeley Sapphires and Rolls-Royce Avons.



The S.O. 4050 Vautour B Two-seat Bomber.

The Vautour has been ordered into quantity production for the French Air Force in all three versions, each powered by two Atar 101E turbojets of 3,500 kg. (7,700 lb.) s.t. each. Later contracts will bring the total number of Vautours on order to several hundred aircraft. Designations of the production aircraft are as follows :—

Vautour A. Single-seat tactical fighter. First production machine of this type flew on April 30, 1956.

Vautour B. Two-seat bomber version.

Vautour N. Two-seat all-weather fighter version.

Among the sub-contractors participating in the production of the Vautour are Nord, SFERMA, Dassault, Bréguet, Ratier, SABCA, Chausson and more than 300 suppliers. It is estimated that more than 15,000 technicians and workers will be engaged in Vautour production for several years.

The following details apply generally to all production versions of the Vautour, except where stated otherwise :—

TYPE.—Multi-rôle Military aircraft.

WINGS.—Mid-wing cantilever monoplane with 35° of sweepback. All-metal structure. Vortex generators forward of ailerons.

FUSELAGE.—Oval-section all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All surfaces swept-back. All-metal structure. Small ventral fin under rear fuselage.

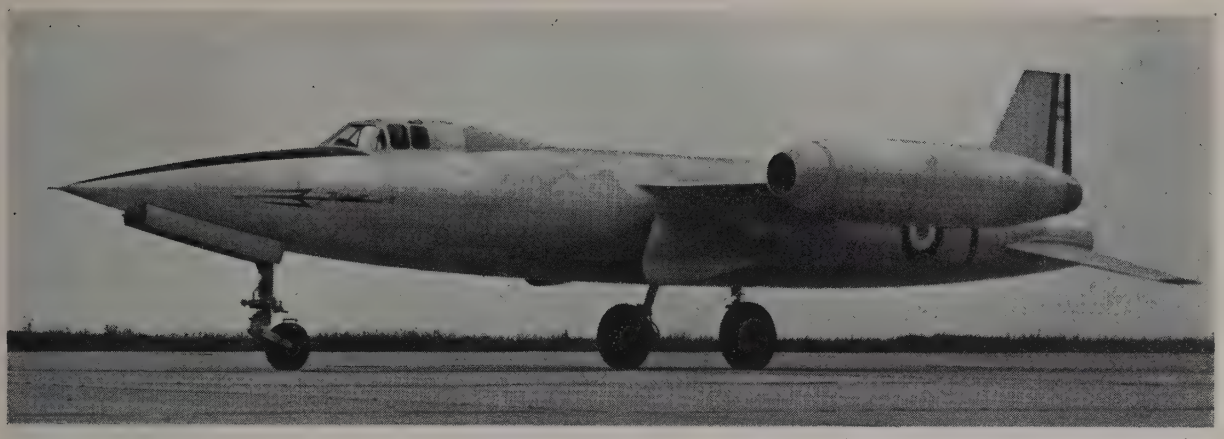
LANDING GEAR.—Retractable tandem type. Two main twin-wheel units in tandem. Front unit retracts forward and rear unit retracts rearward into fuselage fore and aft of bomb-bay. Small outrigger wheel units retract into outboard side of engine nacelles.

POWER PLANT.—Two SNECMA Atar 101E-3 axial-flow turbojet engines, each of 3,500 kg. (7,700 lb.) s.t.

ACCOMMODATION.—Tactical support version



The S.O. 4050 Vautour B Two-seat Bomber (two SNECMA Atar 101E turbojet engines).



The S.O. 9050 Trident II Lightweight Interceptor (two Dassault M.D. 30 Viper turbojets and one SEPR rocket motor).

has single seat. All-weather fighter has two seats in tandem. Bomber has second seat for bomb-aimer in nose. All crew positions are pressurised and provided with Sud-Aviation ejection seats. Irreversible control system incorporates artificial "feel."

ARMAMENT (Tactical support).—Four 30 mm. DEFA guns mounted in the fuselage nose, each with 100 rounds of ammunition. Up to 240 SNEB rockets or ten bombs or a Type B.10 air-to-surface missile in the fuselage bomb-bay. Under-wing pylons for 2×1,250 litre (275 Imp. gallons) drop fuel tanks or four Matra M.116E "honey-comb" packs each containing 19 rockets, or two bombs of up to 450 kg. (1,000 lb.) weight or 24 Type 36 120 mm. rockets.

ARMAMENT (Bomber).—Similar to tactical support aircraft, but without guns. Transparent nose for bomb-aimer.

ARMAMENT (All-weather Fighter).—Four 30 mm. DEFA guns in fuselage nose, each with 100 rounds of ammunition. Up to 240 SNEB rockets in fuselage bomb-bay. Under-wing pylons for two drop fuel tanks or four Matra M.116E "honey-comb" packs each containing 19 rockets or four Matra 5103 air-to-air missiles. Automatic search and tracking fire-control radar, suitable for use with guns, rockets or guided missiles, developed by the Compagnie Générale de Télégraphie Sans Fil (C.S.F.).

DIMENSIONS.—
Span approx. 15 m. (50 ft.).
Length approx. 15 m. (50 ft.).
Height approx. 4.5 m. (15 ft.)

WEIGHTS.—
Weight empty 10,000 kg. (22,000 lb.).
Weight loaded approx. 15,000-20,000 kg. (33,000-44,000 lb.) according to rôle.

PERFORMANCE.—
Max. speed 1,100 km.h. (680 m.p.h.).
Rate of climb at S/L. 3,600 m./min. (11,800 ft./min.).
Ceiling over 15,000 m. (49,200 ft.).

THE S.O. 9050 TRIDENT II.

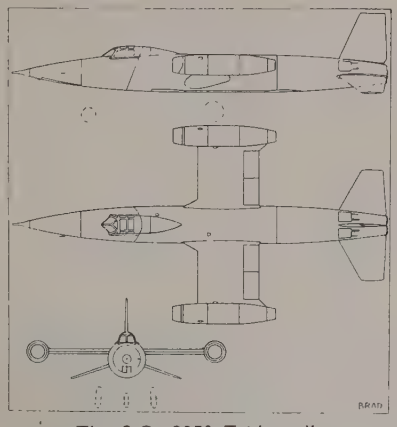
The S.O. 9050 Trident II mixed power unit lightweight interceptor is a direct development of the S.O.9000 Trident I research aircraft, which was described in earlier editions of "All the World's Aircraft."

The contract for two prototypes of the S.O. 9050 was signed in 1954 and the first of these flew on July 17, 1955, using turbojet power only. The first flight with rocket power was made on December 21, 1955. One of these prototypes was destroyed when its rocket fuels mixed accidentally in the air on May 21, 1957.

A pre-production series of six Tridents is now under construction and the first of these flew for the first time on May 3, 1957.

The SEPR 631 rocket-motor which forms the main power plant is installed in the lower part of the rear fuselage. It is fed with a self-igniting mixture of liquid propergol, furaline and nitric acid by turbo-pumps and has two combustion chambers. These give a thrust of 1,500 kg. (3,306 lb.) each and can be fired separately or together, as required.

Two turbojet engines are mounted at the wing-tips for economical cruising at



The S.O. 9050 Trident II.

subsonic speed. With the rocket-motor in use, a maximum level speed greater than Mach 2 is envisaged for a future developed version of the aircraft and its ceiling is said to be "limited only by the pilot's vulnerability at extreme altitude." The Trident II is able to operate from small unprepared airfields.

As in the Trident I, the control surfaces are unconventional. There are no ailerons, and three one-piece all-moving tail surfaces are used for control in bank, pitch and yaw. This is similar to missile practice, and it has been announced that a pilotless long-range ground-to-air interceptor missile is being developed from the basic Trident design.

TYPE.—Single-seat mixed-power Lightweight Interceptor.

WINGS.—Shoulder wing cantilever monoplane of constant chord and section. No spars. Leading-edge, main torsion box and full-span flaps have all-metal bonded "honey-comb" structures. No ailerons. Wing area 14.50 m.² (156 sq. ft.).

FUSELAGE.—Simple all-metal structure of circular section. Air brakes on rear fuselage.

TAIL UNIT.—Cantilever monoplane type, comprising three one-piece all-moving surfaces actuated by Jacottet-Leduc irreversible hydraulic servo-controls. Vertical surface acts as rudder. Lateral surfaces give control in both bank and pitch. (Cockpit controls are conventional).

LANDING GEAR.—Retractable tricycle type, all units of which retract forward into fuselage. Lowered mechanically under combined effect of its own weight and drag and a pneumatic booster. Braking parachutes in rear fuselage.

POWER PLANT.—One SEPR 631 rocket-motor in rear fuselage, with two combustion chambers giving total thrust of 3,000 kg. (6,612 lb.). Two wing-tip mounted turbojets can be either Dassault M.D. 30 Viper (745 kg.=1,644 lb. s.t. each), Turbomeca Gabizo (1,100 kg.=2,425 lb. s.t. each) or Turbomeca Gabizo with reheat (1,500 kg.=3,306 lb. s.t. each.) All fuel and oxidant tanks in centre portion of fuselage. Oxidant tanks can be jettisoned quickly in an emergency.

ACCOMMODATION.—Single seat in pressurised cabin. Jettisonable canopy and lightweight ejection seat. All hydraulic, electrical and radio components mounted together in a single easily-accessible compartment immediately aft of cabin.

ARMAMENT.—Designed to carry an air-to-air guided missile under its fuselage.

DIMENSIONS.—
Span 6.90 m. (22 ft. 7 in.).
Length 13.00 m. (42 ft. 8 in.).
Height 3.20 m. (10 ft. 6 in.).

WEIGHTS.—
Weight empty, equipped 2,625 kg. (5,788 lb.).
Pilot 110 kg. (242 lb.).
Armament 150 kg. (330 lb.).
Fuel and oxidant 2,265 kg. (4,995 lb.).
Weight loaded 5,150 kg. (11,355 lb.).

PERFORMANCE.—
Landing speed approx. 185 km.h. (115 m.p.h.).
Time to 15,000 m. (50,000 ft.) from release of brakes 2 min. 30 sec.
Take-off run less than 500 m. (1,650 ft.).
Landing run less than 500 m. (1,650 ft.).

THE S.O. DELTAVIEX.

The tiny Deltaviex (Delta VX) single-seat research aircraft was designed by the Office National d'Etudes et de Recherches Aéronautiques, built by the former S.N.C.A.S.O. company in 1953 and first flown in the following year; but no information was released until November, 1956.

It was constructed to test in practice several new aerodynamic features including a form of "jet flap." In this, 2% of the output from the compressor of the aircraft's Turbomeca Marboré turbojet power plant is tapped off and blown out through the trailing edge of the flaps. This provides boundary layer control over the inner portions of the wings, at the same time increasing circulation around the wings and providing thrust.

The system is so arranged that the amount of tapped air can be varied between the two flaps. Thus, although normal ailerons are also fitted outboard of the flaps, the flaps themselves are able to be used as inset ailerons during high-speed flight by feeding a differential air pressure.

In other respects, the Deltaviex is fairly conventional. Its wing has a 6% thickness/chord ratio and an area of approximately 5.02 m.² (54 sq. ft.), and the leading-edges are swept back at 70°. A variable-incidence (+1° to −4°) delta tailplane is fitted, and the ailerons and elevators are horn-balanced. A small rudder is mounted at the rear of the under-fin as part of the auto-stabilization control system.

All three units of the tricycle landing gear retract into the fuselage, which is of conventional semi-monocoque design, with large "gutters" forward of the engine air intakes to deflect the boundary layer air above and below the intakes.

DIMENSION.—
Span 3.40 m. (11 ft. 2 in.).
WEIGHT.—
Weight loaded 920 kg. (2,028 lb.).

THE S.E. 3200.

The S.E. 3200 (originally S.E. 316) is a single-rotor turbine-powered helicopter under development for the French Government. No details are available except that two prototypes are being built and that the S.E. 3200 is designed to carry 20-28 passengers.

THE S.E. 3130 ALOUETTE II.

The S.E. 3130 Alouette II is a five-seat helicopter, the rotors of which are driven by a Turbomeca Artouste II shaft turbine. The prototype first flew on March 12, 1955 and was followed by a second prototype and a pre-production batch of three aircraft, the last of which flew on March 6, 1956. A French Certificate of Airworthiness was granted to the Alouette II on May 2, 1957.

A total of 180 Alouette II's has been ordered for service with the French Army, Navy and Air Force, and the French Secretary of State for Air announced in April, 1956, that the production rate of these was to be increased so that they could be sent to support French forces in N. Africa. The first squadron was formed on February 26, 1957, when six Alouettes were flown to Boufarik in Noratlas transports.

A number is also being built for civilian operators and sales have already been made to foreign countries, including Portugal and Sweden. Between 80 and 90 Alouettes had been delivered to military and civilian operators by June, 1957.



The S.E. 3130 Alouette II (Turbomeca Artouste II shaft turbine).

One of the prototypes set up an international helicopter height record of 8,209 m. (26,932 ft.) on June 6, 1955, but this has since been exceeded by an S.O. 1221 Djinn.

TYPE.—Turbine-driven General Purpose Helicopter.

ROTORS.—Three-blade main rotor, two-blade anti-torque rotor. All-metal main rotor blades. Blades on articulated hinges and may be folded towards the rear. Rotor driven through planetary type gear-box (16 : 1 reduction), with free wheel for autorotation. Take-off drive for tail rotor at lower end of main gear-box, from where a torque shaft runs to a small gear-box which supports the tail rotor and houses the pitch change mechanism.

FUSELAGE.—Glazed cabin has light metal frame, centre and rear fuselage triangulated steel-tube framework. Rear fuselage detachable for surface transport.

LANDING GEAR.—Skid type with retractable wheels for ground manoeuvring. Pneumatic floats, inflatable in the air for normal or emergency landings on water, are available.

POWER PLANT.—One Turbomeca Artouste II shaft turbine developing 360 s.h.p. at 33,000 r.p.m. Maximum continuous power 320 s.h.p. Fuel tank (595 litres = 131 Imp. gallons) in centre fuselage.

ACCOMMODATION.—Glazed cabin seats pilot and passenger side-by-side in front and three passengers behind. Can be adapted for flying crane, ambulance, rescue, liaison, observation, training, agricultural, photographic and other duties. As an ambulance can accommodate two stretchers, two sitting casualties and a medical attendant.

DIMENSIONS.—
Main rotor diameter 10.20 m. (33 ft. 6 in.).
Tail rotor diameter 1.80 m. (5 ft. 11 in.).
Overall length, blades folded 9.7 m. (31 ft. 9½ in.).
Overall width 2.08 m. (6 ft. 10 in.).
Height 2.75 m. (9 ft.).

WEIGHTS.—
Weight empty 850 kg. (1,875 lb.).
Disposable load 650 kg. (1,425 lb.).
Normal loaded weight 1,500 kg. (3,300 lb.).



The Gouverneur, the civil executive version of the Alouette II.

PERFORMANCE (at 1,500 kg. = 3,300 lb. A.U.W.).—
Max. speed at S/L. 177 km.h. (110 m.p.h.).
Cruising speed at S/L. 170 km.h. (106 m.p.h.).
Rate of climb 270 m./min. (880 ft./min.).
Service ceiling 3,200 m. (10,500 ft.).
Hovering ceiling with ground effect 2,500 m. (8,200 ft.).
Cruising endurance 3 hrs. 15 min.
Economical cruising range 600 km. (373 miles).

THE S.E. GOUVERNEUR.

The Gouverneur is a civil "executive" transport version of the S.E. 3130 Alouette II, with more luxurious accommodation for a pilot and four passengers, instead of the usual five. Its fuselage is completely covered and streamlined, which adds 29 km.h. (18 m.p.h.) to the cruising speed at a cost of 75 kg. (160 lb.) reduction in payload. Otherwise, this aircraft is similar to the standard Alouette II. The prototype flew for the first time on May 10, 1957 and made its first public appearance at the 1957 Paris International Aero Show.

THE S.E. 3140.

First announced in May, 1957, the S.E. 3140 is a new version of the S.E. 3130 Alouette II powered by a Turbomeca Turmo II shaft-turbine. Being of the "free-turbine" type, this power plant will ensure greater flexibility of operation. In particular, jump take-offs will be possible without imposing strain on the transmission. The S.E. 3140 prototype made its first flight on May 16, 1957.

THE S.O. 1221 DJINN.

The S.O. 1221 is a two-seat turbine-powered helicopter in which the two-blade rotor is driven by compressed air supplied by a Turbomeca Palouste turbo-generator located in the fuselage. There are no combustion chambers at the rotor blade tips. The S.O. 1221 most nearly approaches the ram-jet helicopter in simplicity, but its thermodynamic efficiency and its flying qualities, particularly in autorotation, are said to be much superior.

The prototype flew for the first time on December 16, 1953 and had a take-off weight of 600 kg. (1,320 lb.). This was



The S.O. 1221 Djinn turbine-powered helicopter as an ambulance.

increased subsequently to 700 kg. (1,540 lb.), then to 760 kg. (1,675 lb.), and finally to 800 kg. (1,765 lb.), which is the maximum take-off weight adopted for the current military production version. To comply with the requirements of the Civil Aviation Services, the civilian version has a reduced maximum take-off weight of 760 kg. (1,675 lb.).

The first pre-production Djinn flew on September 23, 1954, and the first production model on January 5, 1956. A French Certificate of Airworthiness was granted to the civil version on May 2, 1957.

Present orders cover the manufacture of more than 120 Djinns, of which 60 are for the French Army, three for the U.S.A.F. and others for civilian customers in 10 different countries. A total of 36 had been delivered by the beginning of June, 1957.

Djinns have been used for a considerable amount of experimental and development flying. One was used by the French Army for air-to-ground launching trials with the Nord S.S. 10 wire-guided anti-tank missile. Another, piloted by Jean Dabos, set up an International Altitude Record for helicopters of all categories on March 22, 1957, by climbing to a height of 8,458 m. (27,730 ft.) at Melun-Villaroche.

TYPE.—Two-seat Jet-driven Helicopter.

ROTOR.—Two-blade rotor on free tilting hub. Light alloy blades have extruded duralumin spar which is keyed to the box-type trailing-edge. Blades attached to blade roots by tensile steel straps which, in turn, are anchored to hub by sealed thrust ball bearings. Compressed air is fed to rotor-tip ejectors through hub, which has a rotating air-sealed joint, and ducts in blade leading-edges. Total disc area 95 m.² (1,022 sq. ft.).



The S.O. 1221 Djinn Helicopter mounted on a lorry for ground transport.

FUSELAGE.—Welded steel-tube structure.

LANDING GEAR.—Skid type. Track 1.85 m. (6 ft.).

POWER PLANT.—One 240 h.p. Turbomeca Palouste IV turbo generator in fuselage supplies compressed air through trunk to rotor hub and blade ducts to rotor-tip ejectors. Fuel tank in fuselage. Fuel capacity 250 litres (55 Imp. gallons). Oil capacity 8 litres (1.76 Imp. gallons).

ACCOMMODATION.—Front of fuselage enclosed by transparent panels and side doors. Can accommodate pilot and passenger or pilot and two stretcher cases. Equipment, dependent on rôle, can include heater, VHF radio, agricultural spraying gear, load dropping gear, float landing gear, etc.

DIMENSIONS.—
Rotor diameter 11 m. (36 ft. 1 in.).
Length of fuselage 5.30 m. (17 ft. 4 in.).
Width of fuselage 1.95 m. (6 ft. 5 in.).
Height (to top of rotor pylon) 2.62 m. (8 ft. 7 in.).

WEIGHTS.—
Weight empty, without doors, equipment or dual controls 330 kg. (728 lb.).
Max. loaded weight (military version) 800 kg. (1,765 lb.).
Max. loaded weight (civil version) 760 kg. (1,675 lb.).

PERFORMANCE (at 700 kg. = 1,543 lb. A.U.W.).—
Max. speed 130 km.h. (80 m.p.h.).
Cruising speed 105 km.h. (66 m.p.h.).
Rate of climb at S/L. 210 m./min. (690 ft./min.).
Hovering ceiling with ground effect 1,500 m. (4,900 ft.).
Max. altitude for vertical take-off 2,800 m. (9,200 ft.).
Range at cruising speed 180 km. (112 miles).
Duration with normal tankage 2¼ hours.

WASSMER

ÉTABLISSEMENTS WASSMER.

HEAD OFFICE AND WORKS: 13, RUE ETIENNE-DOLET, PARIS (20e).

Following production of a batch of 30 light aircraft of Jodel design, this company began work on a further series of 50 Jodel D.112 and D.120 two-seaters in the spring of 1956. The rate of production was scheduled to be about 4 or 5 aircraft per month. The D.120 Paris-Nice is built only by Wassmer and is not available in kit form for amateur construction.

THE JODEL-WASSMER D.120 PARIS-NICE.

The D.120, a de-luxe version of the Jodel D.112, is not intended for amateur production. The prototype flew on June 5, 1955 and the D.120 is now being built in quantity by Wassmer.

Among the many refinements introduced in the D.120 are a redesigned canopy to provide better rearward view; full upholstery in the cabin; radio as standard equipment; spatted wheels, etc. The power-plant is a 90 h.p. Continental C90 flat-four, which gives the aircraft a greatly improved performance.

ZBOROWSKI

BUREAU TECHNIQUE ZBOROWSKI.

HEAD OFFICE: 1, AVENUE D'ORLÉANS, BRUNOY (SEINE ET OISE).

Director: Dipl.-Ing. von Zborowski.

Pioneer of the annular wing coleopter type of aircraft, Dipl.-Ing. von Zborowski formed this Technical Office to develop designs for a wide variety of aircraft utilising this means to vertical take-off and landing.

Current projects include two aircraft and three missiles. Of these, the Charançon VIII BTZ 525-12 is a design for a versatile supersonic aircraft that was conceived as a piloted interceptor but could be utilised as a target drone or for reconnaissance. The Lucane BTZ 511-17 is a projected subsonic aircraft intended basically as a freighter but suitable also as a military or civil transport.

The missile designs under development are the Roitelet BTZ 423-01, which is suitable for surface-to-surface and air-to-air guided weapon or booster applications, and the Ogre BTZ 412-01 and Lutin BTZ 411-01 surface-to-surface weapons.

The European licence for Dipl.-Ing. von Zborowski's patents has been acquired by the SNECMA company, which plans to develop its Flying Atar research vehicle into a Coleopter. The airframes are being built by the Nord company.

GERMANY

THE GERMAN FEDERAL REPUBLIC

AERO

AERO FLUGZEUGBAU HUBERT ZUERL.

HEAD OFFICE AND WORKS: MUNICH-HEIMSTETTEN, NR. MUNICH-RIEM AIRPORT.

This company has been founded by Hubert Zuerl, publisher of the magazine *Aero*, to promote both amateur and industrial construction of light planes of French Jodel design, for which he has acquired the licence rights in Germany and Austria.

Herr Zuerl has adapted the designs of the Jodel models D.9 and D.112 to meet German airworthiness requirements, including the S-4 Category covering training aircraft. The box-spars of aircraft made by his company are built in laminated form, to absorb a landing impact of more than 3 m./sec. (9.84 ft./sec.), and Finnish birch or German beech plywood is used throughout, instead of French okoumé plywood. The resulting somewhat higher take-off weight has been more than offset by adapting the designs to take more powerful engines.

Aero Flugzeugbau Hubert Zuerl supplies plans, amateur construction kits, finished component parts or factory-built aircraft.



The Aero-Jodel D.9a Bébé (45 h.p. Porsche engine).

THE AERO-JODEL D.9a BÉBÉ.

Although basically similar to the standard Jodel D.9, this version has been modified to meet German airworthiness requirements. It is fitted with an adaptation of the 1.5 litre Porsche automobile engine, developing some 45 h.p. for take-off. Compared with the lower-powered D.9, it has much higher performance, including a 50 m. (165 ft.) take-off run, initial rate of climb of 300 m./min. (985 ft./min.) and cruising speed of 150 km.h. (93 m.p.h.).

THE AERO-JODEL D.112 CLUB.

To meet a German Federal Bureau of Aviation requirement making electrical starters obligatory on all new aircraft, Aero Flugzeugbau Hubert Zuerl has fitted its Jodel D.112 aircraft with an 85 h.p. Continental C85-12F engine, instead of the usual A65 engine, which has no such starter.

BLUME

INGENIEUR-BÜRO BLUME.

HEAD OFFICE: TAUSENDFENSTERHAUS, DUISBURG-RUHRORT.

Professor Dipl.-Ing. Walter Blume, chief designer and managing director of the former Arado company, has designed a four-seat all-metal touring and sports aircraft as a replacement for his successful pre-war Arado 79 design. A prototype, known as the Bl.500, has been built by the Focke-Wulf company, with which Prof. Blume's "bureau" is associated. It made its first flight on March 14, 1957.



Two views of the Blume Bl. 500 (150 h.p. Lycoming O-320 engine).

THE BLUME Bl. 500.

TYPE.—Four-seat light cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 7.35. All-metal structure. Parallel chord centre-section and tapered outer wings. Dihedral on outer panels only. Fixed tip fairings act as end-plates to increase effective span. Split flaps on outer wings; slotted flaps on centre-section. Wing area 15 m.² (161.5 sq. ft.).

FUSELAGE.—Semi-monocoque all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All metal structure. Manually-operated trim-tabs in elevators.

LANDING GEAR.—Retractable nose-wheel type. Main wheels retract upwards and protrude slightly from wings in "up" position to reduce damage in a wheels-up landing.

POWER PLANT.—One 150 h.p. Lycoming O-320-A2A four-cylinder, horizontally-opposed air-cooled engine, driving two-blade variable-pitch propeller. Two fuel tanks in wing centre-section, one on each side of fuselage.

ACCOMMODATION.—Enclosed cabin for four persons. Entry by opening upward both sides of canopy, which are hinged on centre-line. Air conditioned cabin.

DIMENSIONS.—
Span 10.50 m. (34 ft. 5 in.).
Length 8.15 m. (26 ft. 9 in.).
Height 2.40 m. (7 ft. 10½ in.).

WEIGHTS.—
Weight empty 612 kg. (1,350 lb.).
Weight loaded 1,060 kg. (2,337 lb.).

PERFORMANCE.—
Max. speed 246 km.h. (153 m.p.h.).
Cruising speed (70% power) 219 km.h. (136 m.p.h.).
Landing speed approx. 80 km.h. (50 m.p.h.).
Rate of climb at S/L. 319 m./min. (1,045 ft./min.).
Ceiling 5,800 m. (19,000 ft.).
Take-off distance to 15 m. (50 ft.) 275 m. (902 ft.).
Landing distance from 15 m. (50 ft.) 257 m. (845 ft.).
Range 900 km. (560 miles).

BURGFALKE

BURGFALKE FLUGZEUGBAU.

HEAD OFFICE AND WORKS: BURGLENGENFELD, BEI REGENSBURG, BAVARIA.

Director: Ing. M. J. Dahmen.

This company is developing a two-seat semi-aerobatic light aircraft known as the M-150 Schulmeister, which is based on the A15 (WN-16) aircraft designed by the ormer Wiener-Neustadt company.

THE BURGFALKE M-150 SCHULMEISTER (SCHOOLMASTER).

TYPE.—Two-seat "Pusher" monoplane.

WINGS.—Cantilever low-wing monoplane. NACA 23 series wing section. Aspect ratio 7.15. Wooden structure with plywood-covered leading edge and undersurfaces, rest fabric-covered. Wing area 13.50 m.² (145.3 sq. ft.).

FUSELAGE.—Tubular structure, using chrome-molybdenum steel tube in highly-stressed parts and commercial steel tube elsewhere. Fabric-covered.

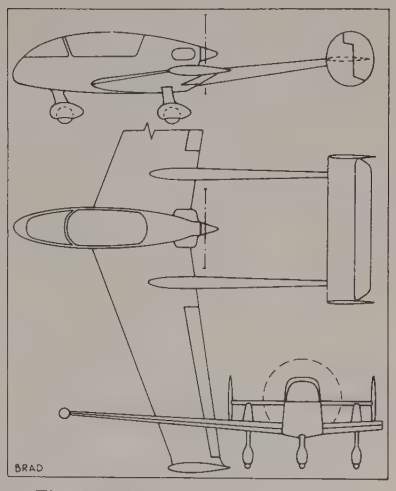
TAIL UNIT.—Cantilever monoplane type with twin fins and rudders, carried on twin tail-booms. All-wood construction.

LANDING GEAR.—Fixed tricycle type. Rubber-in-compression shock-absorbers. Brakes on main wheels. Steerable nose-wheel. Wheel spats. Wheel track 2.20 m. (7 ft. 3 in.).

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine, arranged as "pusher" and driving a Hoffmann two-blade wooden propeller. Alternatively a 55 or 75 h.p. Porsche engine. Fuel tank in fuselage forward of engine. Provision for wing-tip tanks.

ACCOMMODATION.—Two seats in tandem under large transparent canopy. Dual controls and instruments optional.

DIMENSIONS.—
Span 9.84 m. (32 ft. 4 in.).
Length 7.27 m. (23 ft. 10 in.).
Height 1.80 m. (5 ft. 11 in.).
WEIGHTS AND LOADINGS.—
Weight empty 350 kg. (772 lb.).
Max. loaded weight 590 kg. (1,300 lb.).
Wing loading 40.7 kg./m.² (8.33 lb./sq. ft.).
Power loading 11.0 kg./h.p. (24.25 lb./h.p.).
PERFORMANCE (estimated).—
Max. speed 175 km.h. (109 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Landing speed 60 km.h. (37 m.p.h.).
Ceiling 4,200 m. (13,780 ft.).
Normal range 500 km. (310 miles).



The Burgfalke M-150 Schulmeister.

DITTMAR

MÖWE-FLUGZEUGBAU HEINI DITTMAR.

ADDRESS: BÜRGERMEISTER FISCHER STR. 12/IV, AUGSBURG.

Technical Director: Dipl.-Ing. Horst Rabsilber.

Commercial Director: James G. Lau.

Heini Dittmar, the well-known glider expert, has built the prototype of a two-seat light club and touring aircraft known as the HD 153 Möwe. The prototype made its first flight in November, 1953 and has been tested with various engines including a 65 h.p. Continental and 70 h.p. Hirth HM.60. The first production model with a 90 h.p. Continental engine flew in May, 1956.

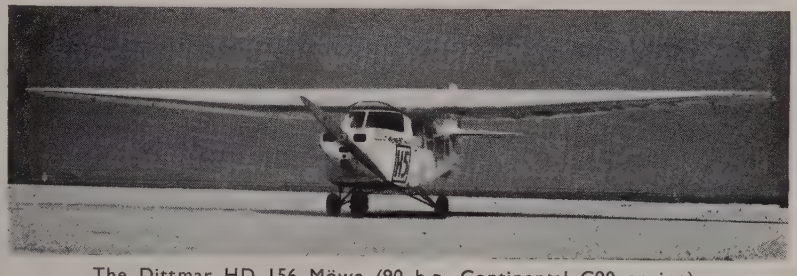
THE DITTMAR MÖWE.

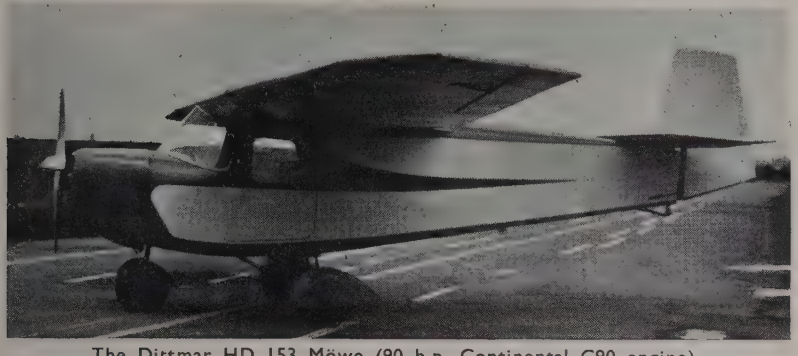
Two versions of the Möwe are available, as follows:—

HD 153 Möwe. Standard version with two seats side-by-side.

HD 156 Möwe. Basically as HD 153, but with a third seat and additional side windows to rear of cabin.

TYPE.—Two/three-seat Light monoplane.
WINGS.—Cantilever high-wing monoplane. Göttingen 367 (modified) wing section. Aspect ratio 8.5. Dihedral 2°. Single-spar wooden structure, with plywood-covered leading-edge torsion box and fabric-covering overall. Wooden ailerons and flaps. Total area of ailerons 1.32 m.² (14.2 sq. ft.). Total area of flaps 0.15 m.² (1.61 sq. ft.). Gross wing area 18.3 m.² (197 sq. ft.).
FUSELAGE.—Wooden frames and stringers, plywood-covered.
TAIL UNIT.—Cantilever monoplane type, without fixed fin. Wooden structure with plywood covering Areas: rudder 0.98 m.² (10.55 sq. ft.), tailplane 1.56 m.² (16.79 sq. ft.), elevators 1.0 m.² (10.76 sq. ft.). Tailplane span 2.80 m. (9 ft. 2 in.).
LANDING GEAR.—Fixed tricycle type. Rubber springing on main wheels. Nose-wheel on spring-loaded strut. All wheels FAGU-Rad 380 × 150 with FAGU-Bremsen brakes. Steerable nose-wheel. Wheel spats optional. Wheel track 1.90 m. (6 ft. 3 in.). Wheelbase 1.40 m. (4 ft. 7 in.).
POWER PLANT.—One 90 h.p. Continental C90 12F four-cylinder horizontally-opposed air-cooled engine, with Hoffmann "Hoco" two-blade fixed-pitch wooden airscrew. Fuel in two tanks in wing centre-section, each of 70 litres (15.4 Imp. gal.) capacity. Oil capacity 4.5 litres (1 Imp. gal.).


The Dittmar HD 156 Möwe (90 h.p. Continental C90 engine).


The Dittmar HD 153 Möwe (90 h.p. Continental C90 engine).

ACCOMMODATION.—Enclosed cabin seating two side-by-side in HD 153, with additional seat to rear in HD 156. Luggage space aft of seats.
DIMENSIONS.—
Span 12.0 m. (39 ft. 4 in.).
Length 6.5 m. (21 ft. 4 in.).
Height 2.10 m. (6 ft. 10½ in.).
WEIGHTS.—
Weight empty, equipped 465 kg. (1,025 lb.).
Weight loaded 760 kg. (1,675 lb.).
PERFORMANCE.—
Max. speed 170 km.h. (106 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Landing speed 65 km.h. (40 m.p.h.).
Time to 1,000 m. (3,280 ft.) 6 min.
Service ceiling 4,500 m. (14,760 ft.).
Take-off distance 150 m. (492 ft.).
Landing distance 130 m. (425 ft.).
Range 1,000 km. (620 miles).

DORNIER

DORNIER-WERKE G.m.b.H.

HEAD OFFICE: FRIEDRICHSHAFEN a.B.
MAIN FACTORIES: NEUAUBING, NEAR MUNICH.
AIRFIELD: OBERPFAFFENHOFEN, BAVARIA.

Founder and Director: Prof. Dr. Claude Dornier.

During their four decades in the aircraft industry, the Dornier-Werke G.m.b.H., formerly Dornier-Metallbauten, have built many famous types, including the Wal flying boat, the Do X which was the largest flying boat of its day, the Do 17 bomber and the Do 335 twin-engined fighter with tractor and pusher airscrews.

After the war, when the design and manufacture of aircraft in Germany was forbidden, Dr. Dornier established technical offices in Madrid, Spain, where he designed a general purpose monoplane known as the Do 25. Now that aircraft production is again possible in Germany, an advanced development of this aircraft designated the Do 27 is being built by the new Dornier-Werke. 428 Do 27's have been ordered for the new German Air Force.

THE DORNIER Do 27.

The Dornier Do 27 is a development of the Do 25 general purpose monoplane, which was designed and built by the Oficinas Tecnicas Dornier in Madrid, Spain, and has been described fully in earlier editions of "All the World's Aircraft." The prototype Do 27 flew for the first time on June 27, 1955, and the first production aircraft on October 17, 1956.

There are two versions, of which the standard Do 27 with 270 h.p. Lycoming engine is described below. The Do 27B is similar, but with 290 h.p. Lycoming engine and loaded weight of 1,600 kg. (3,527 lb.).

TYPE.—Single-engined General-purpose monoplane.
WINGS.—High-wing cantilever monoplane. Wing section NACA 23018 (modified). Aspect ratio 7.42. Chord 1.65 m. (5 ft.



The Dornier Do 27 (270 h.p. Lycoming GO-480 engine).

5 m.). No dihedral. Incidence 4.5°. All metal box-spar structure. Forward portion of wing is a metal-skinned torsion box with a built-in fixed slot over entire span. Rear portion of wing is fabric-covered. Wing-tips are metal-covered. Ailerons have metal structure with fabric covering. Double-slotted flaps have metal structure, partly fabric-covered. Total area of ailerons 2.65 m.² (28.5 sq. ft.). Total area of flaps 3.6 m.² (38.75 sq. ft.). Gross wing area 19.4 m.² (208.8 sq. ft.).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with fabric-covered rudder and elevators. Total area of tailplane and elevators 4 m.² (43 sq. ft.). Total area of fin and rudder 2.56 m.² (27.5 sq. ft.). Tailplane span 3.8 m. (12 ft. 4 in.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever main wheel units with oleo-pneumatic shock absorbers and hydraulic brakes. Tail-wheel has rubber shock-strut. Goodyear main wheels size 530 × 216 mm. Tail-wheel size 200 mm. Wheel track 2.29 m. (7 ft. 6 in.).

POWER PLANT.—One 270 h.p. Lycoming GO-480-B1A6 six-cylinder horizontally-opposed air-cooled engine with 2.48 m. (8 ft. 2 in.) diameter two-blade Hartzell airscrew. Fuel in two wing tanks, with a total capacity of 210 litres (46.2 Imp. gallons). Two additional pod tanks can be carried under wings, with a total capacity of 120 litres (26.4 Imp. gallons). Oil capacity 10 litres (2.2 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating up to six persons in civil version, or four persons in military observation, ambulance and liaison version. Four large entry doors.

DIMENSIONS.—
- Span 12 m. (39 ft. 4½ in.).
- Length 9.6 m. (31 ft. 6 in.).
- Height 3.5 m. (11 ft. 6 in.).

WEIGHTS AND LOADINGS (civil 5-seat version).—
- Weight empty 985 kg. (2,167 lb.).
- Disposable load (normal) 515 kg. (1,133 lb.).
- Disposable load (max.) 615 kg. (1,353 lb.).
- Normal loaded weight 1,500 kg. (3,300 lb.).
- Max. permissible loaded weight 1,600 kg. (3,520 lb.).
- Normal power loading 5.55 kg./h.p. (12.25 lb./h.p.).
- Max. power loading 5.95 kg./h.p. (13.09 lb./h.p.).

PERFORMANCE (Do 27—1,500 kg. = 3,300 lb. A.U.W.).—
- Max. speed at 1,000 m. (3,280 ft.) 250 km.h. (155 m.p.h.).
- Cruising speed (60% power) 205 km.h. (127 m.p.h.).
- Stalling speed 57 km.h. (35.5 m.p.h.).
- Landing speed 65 km.h. (40.4 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 2.6 min.
- Climb to 2,000 m. (6,560 ft.) 6.5 min.
- Climb to 3,000 m. (9,840 ft.) 12 min.
- Ceiling 5,500 m. (18,040 ft.).
- Take-off run, max. fuel, no wind 90 m. (98 yds.).
- Take-off to clear 15 m. (50 ft.), max. fuel, no wind 170 m. (186 yds.).
- Landing run, no wind 75 m. (82 yds.).
- Landing from 15 m. (50 ft.) no wind 160 m. (175 yds.).
- Cruising range 870 km. (540 miles).

PERFORMANCE (Do 27B—1,600 kg. = 3,520 lb. A.U.W.).—
- Max. speed at 1,000 m. (3,280 ft.) 248 km.h. (154 m.p.h.).
- Cruising speed (60% power) 201 km.h. (125 m.p.h.).
- Stalling speed 58 km.h. (36 m.p.h.).
- Landing speed 65 km.h. (40.4 m.p.h.).
- Climb to 1,000 m. (3,280 ft.) 3.5 min.
- Climb to 2,000 m. (6,560 ft.) 7.5 min.
- Climb to 3,000 m. (9,840 ft.) 13.5 min.
- Ceiling 5,000 m. (16,400 ft.).
- Cruising range 790 km. (490 miles).
- Cruising range with auxiliary tanks 1,315 km. (817 miles).

FOCKE-WULF

FOCKE-WULF G.m.b.H.

HEAD OFFICE AND WORKS: HÜNEFELDSTRASSE 1-5, BREMEN-FLUGHAFEN.

Director: Arthur Rothe.

The reconstituted Focke-Wulf company has its administrative building and small workshops at Bremen Airport, where a nucleus of 200 skilled workers began by building Kranich III and Weihe gliders and general engineering products.

The company is grouped with the engineering office of Professor Blume at Duisburg, and the prototype of the Blume 500 was built by Focke-Wulf.

The Focke-Wulf-Blume group has started to build under licence the Piaggio P.149D training and liaison aircraft for the German Air Force. An initial batch of 75 of the 194 ordered by the German Federal Republic will be built by the Piaggio company. Piaggio is also providing technical assistance and will supply the Lycoming GO-480-B1B engines, which Piaggio builds under licence, as well as airscrews for the German-built P.149D's.

HAMBURGER

HAMBURGER FLUGZEUGBAU G.m.b.H.

HEAD OFFICE AND WORKS: KREETSLAG 10, HAMBURG-FINKENWERDER.

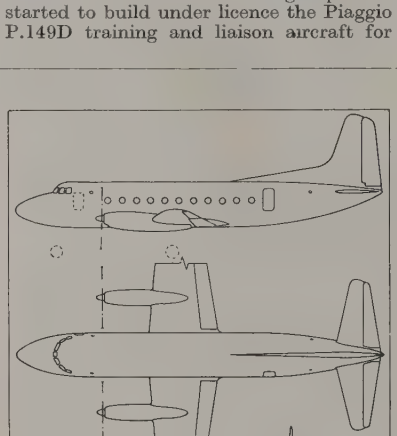
ADDRESS: POSTFACH 11524, HAMBURG-FINKENWERDER.

This is the aviation division of the great Blohm and Voss ship-building company, which built many seaplanes for the pre-war Lufthansa and for the old *Luftwaffe*. It is one of the three companies making up the Flugzeugbau Nord G.m.b.H. group, which will manufacture the French Nord 2501 Noratlas transport under licence. Hamburger will be responsible for the production of Noratlas fuselages, as well as for the final assembly and flight testing.

Preparations are being made for the manufacture of complete aircraft, and development of a twin-engined transport known as the HFB-209 has begun.

THE HAMBURGER HFB-209.

This transport aircraft will be basically similar to the CASA-207 Azor, a description of which appears in the Spanish section of this work. It will, however, be powered normally by two 3,500 h.p. Napier Eland N.El.6 turboprops and will have accommodation for a crew of four and 48-54 passengers.



The Hamburger HFB-209.

Alternative power plants are the 3,750 h.p. Allison 501-D13 and 4,200 h.p. Rolls-Royce Tyne.

DIMENSIONS.—
- Span 28.55 m. (93 ft. 8 in.).
- Length 23.32 m. (76 ft. 6 in.).
- Height 9.04 m. (29 ft. 8 in.).

WEIGHTS AND LOADINGS (Eland engines).—
- Weight empty 10,910 kg. (24,050 lb.).
- Weight loaded 20,450 kg. (45,080 lb.).
- Wing loading 229 kg./m.² (46.8 lb./sq. ft.).
- Power loading 2.92 kg./h.p. (6.44 lb./h.p.).

PERFORMANCE (Eland engines, estimated).—
- Max. speed at 6,000 m. (19,680 ft.) 568 km.h. (353 m.p.h.).
- Cruising speed at 6,000 m. (19,680 ft.) 512 km.h. (318 m.p.h.).
- Landing speed 156 km.h. (97 m.p.h.).
- Rate of climb at S/L. 690 m./min. (2,260 ft./min.).
- Climb to 6,000 m. (19,680 ft.) 13 min.
- Service ceiling 10,600 m. (34,800 ft.).
- Take-off distance to 10 m. (33 ft.) 565 m. (1,850 ft.).
- Take-off distance following one engine failure at critical point 1,185 m. (3,900 ft.).
- Landing distance from 15 m. (50 ft.) 650 m. (2,130 ft.).
- Landing run using airscrew reverse-pitch 385 m. (1,260 ft.).
- Stage length with 48 passengers, with reserves 1,900 km. (1,180 miles).

HEINKEL

ERNST HEINKEL FAHRZEUGBAU G.m.b.H.

HEAD OFFICE AND WORKS: SPEYER A. RHEIN.

Managing Director: Alfred Klein.

Director: F. F. C. Walter.

Sales Director: F. W. Seekatz.

Technical Management: Prof. Dr.-Ing. Karl Thalau and Karl Schwärzler.

Chief of Design Office: Dipl-Ing. Siegfried Günter.

Chief of Aerodynamic Dept: Dr.-Ing. Erich Truckenbrodt.

Formed in 1955, the Ernst Heinkel Fahrzeugbau G.m.b.H. had its origin in the Ernst Heinkel Flugzeugwerke of Warnemünde and Rostock, formed in 1922, and the later Ernst Heinkel Aktiengesellschaft of Rostock, Berlin and Vienna. These companies built many famous aircraft, including the He 178, which was the first jet-propelled aeroplane to fly, on August 27, 1939.

When aircraft production in West Germany was again permitted, the company engaged many of its former staff and re-started its design and construction activities. The factory at Speyer is building under licence the French Fouga CM. 170R Magister jet-trainer, and will also undertake repair and overhaul work for the new German Air Force.

The Magister production contract is held jointly by Heinkel and Messerschmitt A.G. and the association of these two companies is known as Flugzeug Union Sud, G.m.b.H.

JUNKERS

JUNKERS FLUGZEUG-UND MOTOREN-WERKE G.m.b.H.

HEAD OFFICE: THEATERPLATZ 1, BAD GODESBERG.

The Junkers company is engaged at present on aviation research and development work. It is intended to resume the manufacture of aircraft and aero-engines in due course.

The company's business management consists of Mr. Kurt Adenauer, Dr. Ing. August Lichte and Mr. Friedrich Peters.

KLEMM

HANNS KLEMM FLUGZEUGBAU, LEICHTFLUGZEUGBAU KLEMM G.m.b.H.

HEAD OFFICE: KARL BENZ-STRASSE, BÖBLINGEN, WÜRTTEMBERG.

Dr.-Ing. Hanns Klemm joined the design office of the Dornier company in 1917 and, after a brief period with this company and with Heinkel, was appointed chief aircraft designer of Daimler-Motor-engesellschaft. By 1924, he had perfected the design of a light plane known as the Klemm-Daimler L15, with a 12.5 h.p. Indian engine. This was followed by the L20 cantilever low-wing monoplane, with 20 h.p. Mercedes engine, which achieved great success and formed the basis of all subsequent Klemm light aeroplane designs.

In December, 1926, Dr. Klemm formed his own manufacturing company, the Leichtflugzeugbau Klemm, which produced large numbers of sporting aircraft before the outbreak of war in 1939.

The Klemm works were destroyed completely during the war and no new factory has yet been opened. But a prototype of the wartime-designed Kl 107 light aircraft was completed in 1955 and it is hoped to put this type into production in the near future.

THE KLEMM Kl. 107.

TYPE.—Two-seat Light monoplane.

WINGS.—Cantilever low-wing monoplane. Wing section 230 series. Aspect ratio 8. Mean chord 1.44 m. (4 ft. 9 in.). Dihedral 6°. Single-spar wooden structure with plywood covering forward of spar and fabric covering aft of spar. Wooden ailerons with plywood leading-edge and fabric covering. Wooden split flaps. Total area of ailerons 1.20 m.² (12.92 sq. ft.). Total area of flaps 0.89 m.² (9.58 sq. ft.). Gross wing area 14.6 m.² (157.15 sq. ft.).

FUSELAGE.—Wooden monocoque structure.

TAIL UNIT.—Wooden monoplane structure, plywood and fabric-covered. Areas: fin 0.65 m.² (7 sq. ft.), rudder 0.75 m.² (8.07 sq. ft.), elevators 1.0 m.² (10.76 sq. ft.), tailplane 1.46 m.² (15.72 sq. ft.). Tailplane span 3.30 m. (10 ft. 10 in.).

LANDING GEAR.—Fixed tail-wheel type. Klemm shock absorbers. Dunlop Av 660 wheels. Dunlop hydraulic plate brakes. Wheel track 1.634 m. (5 ft. 4 in.).

POWER PLANT.—One 90 h.p. Continental C90-12F four-cylinder horizontally-opposed air-cooled engine. Schwarz two-blade wooden airscrew. Fuel in two tanks in fuselage of 80 litres (17.6 Imp. gallons) and 20 litres (4.4 Imp. gallons) capacity. Oil capacity 5 litres (1 Imp. gallon).

ACCOMMODATION.—Normally two persons side-by-side, but one person only when used for aerobatics. Dual controls.

DIMENSIONS.—
Span 10.88 m. (35 ft. 8 in.).
Length 8.30 m. (27 ft. 3 in.).
Height 2.15 m. (7 ft. 1 in.).

WEIGHTS.—
Normal weight loaded (2 seats) 860 kg. (1,896 lb.).
Weight loaded (semi-aerobatic, 2 seats) 740 kg. (1,631 lb.).
Weight loaded (aerobatic, 1 seat) 625 kg. (1,378 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Landing speed 80 km.h. (50 m.p.h.).
Rate of climb at S/L. 180 m./min. (590 ft./min.).

MESSERSCHMITT

MESSERSCHMITT A.G.

HEAD OFFICE AND DESIGN OFFICE: TÖLZERSTRASSE 40, MUNICH 25.

WORKS: HAUNSTETTERSTRASSE 148, AUGSBURG AND REGENSBURGER STAHL- UND METALLBAU G.M.B.H., PRÜFENINGERSTRASSE 104, REGENSBURG.

Chairman: Dr. Ing. E.h. Willy Messerschmitt.

Technical Director: Prof. Dr.-Ing. Karl Thalau.

Commercial Director: Siegfried Keller.

Director: Dipl. Ing. Eberhard Stromeyer.

After the war Dr. Ing. Messerschmitt continued his aircraft design activities in Spain. With a group of designers from the former Messerschmitt company, including Hans Hornung, he developed the HA-100 and HA-200 trainers for the Hispano company and the HA-100 is now in large-scale production for the Spanish Air Force.

Now, in collaboration with the Heinkel company, his re-constituted Messerschmitt A.G. company is undertaking the manufacture of 210 French Fouga Magister advanced jet-trainers for the new German Air Force, after initial assembly of 40 French-built Magisters.

Messerschmitt is reported to have purchased the site for a new aircraft factory at Essen, under the name of Messerschmitt Rheinland G.m.b.H. The Regensburg works is at present engaged in manufacturing the Messerschmitt cabin motor-scooter.

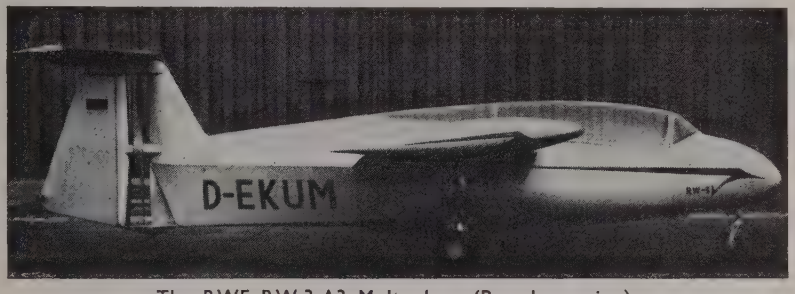
RWF

RHEIN-WEST-FLUG FISCHER u. COMPANIE.

HEAD OFFICE: AMSELSTRASSE 5, PORZ-WESTHOVEN.

This company was formed to develop a new aircraft configuration conceived by H. Fischer of Porz-Westhoven, near Cologne, in which forward thrust is provided by an airscrew mounted in a slot between the fin and rudder. When applied to the powered sailplane type of aircraft the airscrew can be housed vertically in the slot during motorless flight to offer minimum drag.

First flight tests of the new configuration were made on an aircraft known as the Fibo 2A, powered by a DKW engine. Mr. Fischer then designed in 1955 a powered glider on the same lines, known as the RW.3. Its components were built by the well-known glider-maker Ing. H. Gomolzig, and it flew within a year of the start of detailed design work.



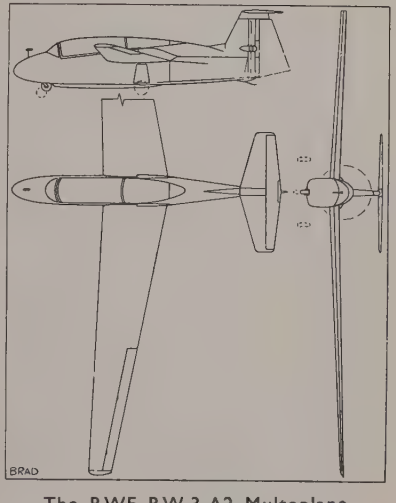
The RWF RW.3-A3 Multoplane (Porsche engine).

THE RWF RW.3-A2 MULTOPLANE.

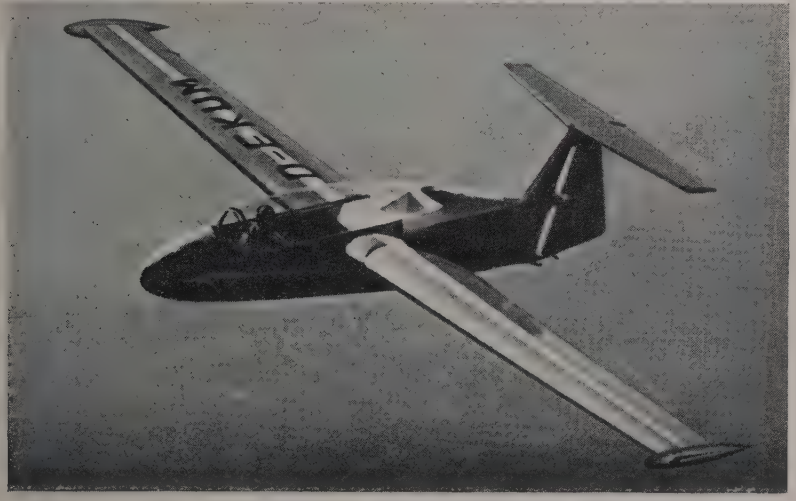
Powered during its early flight trials by a 50 h.p. Porsche engine, the RW.3 is also designed to take the more powerful 65 h.p. Porsche-Super or 100 h.p. Porsche-Spyder engines.

TYPE.—Two-seat Power-assisted sailplane.

WINGS.—Shoulder-wing cantilever monoplane. Laminar-flow wing section. Aspect ratio 12.5. All-metal structure with Pantal light alloy covering. Wing area 18 m.² (193.7 sq. ft.).



The RWF RW.3-A2 Multoplane.



The RWF RW.3-A3 Multoplane (Porsche engine).

FUSELAGE.—Welded steel structure with plastic skin covering.

TAIL UNIT.—Cantilever monoplane type with horizontal surfaces mounted at tip of fin. Slot between fin and rudder in which airscrew is mounted. All-metal structure.

LANDING GEAR.—Retractable tricycle type. All units retract into fuselage.

POWER PLANT.—One 50 h.p. Porsche, 65 h.p. Porsche-Super or 100 h.p. Porsche-Spyder air-cooled engine, mounted aft of the cockpit and driving a two-blade fixed-pitch airscrew located in a slot between the fin and rudder. The airscrew can be housed vertically in the slot for motorless flight. Total fuel capacity 60 litres (13.2 Imp. gallons) carried in wing tanks.
ACCOMMODATION.—Enclosed cabin seating two in tandem. Rearward-sliding transparent canopy.
DIMENSIONS.—
Span 15 m. (49 ft. 3 in.).
Length 7.4 m. (24 ft. 4 in.).
Height 2.1 m. (6 ft. 10½ in.).
WEIGHTS AND LOADINGS.—
Weight empty 445 kg. (982 lb.).
Max. loaded weight 650 kg. (1,434 lb.).
Wing loading 36.1 kg./m.² (7.4 lb./sq. ft.).
Power loading (65 h.p. engine) 10.0 kg./h.p. (22 lb./h.p.).
Power loading (100 h.p. engine) 6.5 kg./h.p. (14.3 lb./h.p.).
PERFORMANCE (65 h.p. engine).—
Max. speed at S/L. 209 km.h. (130 m.p.h.).
Cruising speed at S/L. 198 km.h. (123 m.p.h.).
Landing speed 63 km.h. (39 m.p.h.).
Rate of climb at S/L. 205 m./min. (668 ft./min.).
Service ceiling over 4,000 m. (13,000 ft.).
Take-off run 203 m. (665 ft.).
Range 900 km. (560 miles).
PERFORMANCE (100 h.p. engine).
Max. speed at S/L. 242 km.h. (150 m.p.h.).
Cruising speed at S/L. 230 km.h. (143 m.p.h.).
Landing speed 63 km.h. (39 m.p.h.).
Rate of climb at S/L. 365 m./min. (1,200 ft./min.).
Service ceiling over 4,000 m. (13,000 ft.).
Take-off run 168 m. (550 ft.).
Range 550 km. (345 miles).

THE RWF RW.3-A3 MULTOPLANE.

This version is an aerobatic and sporting aircraft. It is basically similar to the RW.3-A2, with the same choice of power plants, but with the wing span reduced from 15 m. (49 ft. 3 in.) to 10 m. (32 ft. 10 in.), giving an area of 14 m.² (150.7 sq. ft.) and aspect ratio of 7.15. Auxiliary fuel tanks fitted to the wing-tips increase the effective wing span and give a total fuel capacity of 120 litres (26.4 Imp. gallons). The landing flaps of the A2 become the ailerons on the A3.

Constructional and specification data are similar with the following exceptions.

WEIGHTS AND LOADINGS.—
Weight empty 430 kg. (949 lb.).
Wing loading 46.4 kg./m.² (9.5 lb./sq. ft.).
PERFORMANCE (65 h.p. engine).
Max. speed at S/L. 212 km.h. (132 m.p.h.).
Cruising speed at S/L. 200 km.h. (124 m.p.h.).
Landing speed 75 km.h. (47 m.p.h.).
Rate of climb at S/L. 180 m./min. (590 ft./min.).
Take-off run 261 m. (855 ft.).
Range 1,900 km. (1,180 miles).
PERFORMANCE (100 h.p. engine).—
Max. speed at S/L. 246 km.h. (153 m.p.h.).
Cruising speed at S/L. 232 km.h. (144 m.p.h.).
Landing speed 75 km.h. (47 m.p.h.).
Rate of climb at S/L. 335 m./min. (1,100 ft./min.).
Take-off run 220 m. (720 ft.).
Range 1,430 km. (890 miles).

SCHEIBE

SCHEIBE-FLUGZEUGBAU G.m.b.H.

HEAD OFFICE: AUGUST-PFALTZ-STRASSE 23, DACHAU, NR. MUNICH.
WORKS: MUNICH-RIEM AIRPORT.
Manager: Dipl.-Ing. Egon Scheibe.
Chief Designer: Dipl.-Ing. H. Hartmann.

Scheibe-Flugzeugbau G.m.b.H. was founded at the end of 1951 by Dipl.-Ing. Scheibe, who had previously built a prototype two-seat general purpose glider known as the Mü-13E Bergfalke in Austria. This aircraft flew for the first time on August 5, 1951, and was the first type produced in quantity by the newly-formed company.

The Mü-13E was followed by the Spatz, a mid-wing monoplane glider which made its first flight on March 12, 1952, and the single-seat L-Spatz with increased wing span. The prototype of the Specht two-seat training glider was completed in March, 1953, and has been developed into the side-by-side two-seat Sperber, which is now in production.

From the Mü-13E, the Bergfalke II two-seat glider with swept-forward wings was developed and this is still in production as the Bergfalke II/55. The Spatz was also developed further as the high-wing Spatz-55 and L-Spatz-55.

In addition, Scheibe has built a single-seat high-performance contest sailplane with laminar-flow swept-forward wings, known as the Zugvogel, and Hanna Reitsch used an aircraft of this type to win the 1955 German gliding competitions. The latest version is the Zugvogel-III, the prototype of which flew for the first time in April, 1957.

All of these gliders have steel-tube fuselage construction.

After the construction of powered aircraft again became permissible in Germany, Scheibe began work on a small two-seat light aeroplane. Known as the Sperling and powered by a 65 h.p. Continental engine, it made its first flight on August 8, 1955.

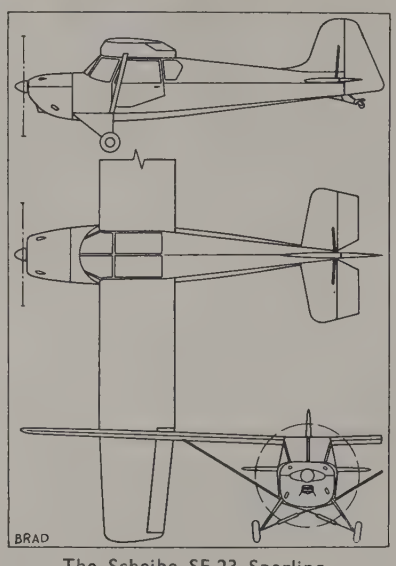
From its foundation until March, 1957, Scheibe built a total of more than 275 aircraft of various types, in addition to many kits for home construction by amateurs. Gliders of Scheibe design have been built under licence by other companies and by gliding clubs.

THE SCHEIBE SF-23 SPERLING (SPARROW).

Since the prototype of the Sperling flew on August 8, 1955, it has undergone continuous development. In September, 1956, the original wing of Mü aerofoil section was replaced by a new wing of NACA section and somewhat larger area. The wooden tail unit was also replaced by a new unit of welded steel-tube construction.



The Scheibe SF-23 Sperling (95 h.p. Continental C90 engine).



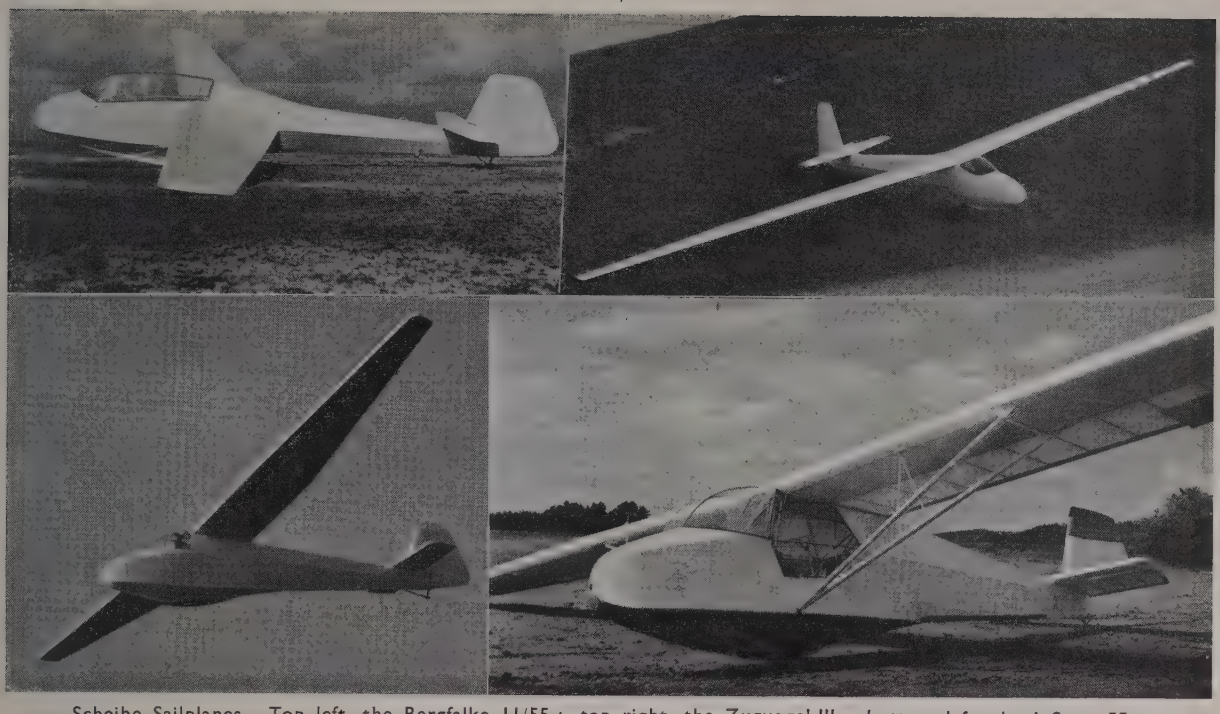
The Scheibe SF-23 Sperling.

In April, 1957, the original 65 h.p. Continental A65 engine was replaced by a 95 h.p. Continental C90 engine to provide adequate reserve power for towing heavy two-seat sailplanes and to meet German airworthiness requirements for a self-starter to be provided. But the Continental A65, the 85 h.p. Continental C85 or 65 h.p. Porsche engines are offered as alternative power plants to the C90 in production aircraft.

TYPE.—Two-seat light monoplane.
WINGS.—High-wing braced monoplane with quickly-removable wings. Wing section NACA 23012. Dihedral 1.5°. Incidence 2.5°. Chord 1.30 m. (51.2 in.) at root, 1.0 m. (39.4 in.) at tip. Aspect ratio 8. Wooden two-spar structure with plywood and fabric covering. Ailerons are counter-balanced and have plywood covering on their top surfaces. Streamline-section steel-tube bracing struts. Total area of ailerons 1.09 m.² (11.73 sq. ft.). Wing area 12.16 m.² (130.9 sq. ft.).
FUSELAGE.—Steel-tube structure. Fabric-covered.
TAIL UNIT.—Braced monoplane type. Steel-tube structure with fabric covering. Fin and tailplane integral with fuselage. Trim-tab in elevator. Areas: tailplane 0.65 m.² (7.0 sq. ft.), elevators 0.69 m.² (7.43 sq. ft.), fin 0.30 m.² (3.23 sq. ft.), rudder 0.54 m.² (5.81 sq. ft.).
LANDING GEAR.—Fixed tailwheel type. Rubber shock-absorbers. Main wheels 5.00 × 4. Brakes. Tail-wheel mounted on leaf spring and connected to rudder for ground manoeuvring.
POWER PLANT.—One 95 h.p. Continental C90-12F four-cylinder horizontally-opposed air-cooled engine, driving a two-blade wooden fixed-pitch airscrew. Fuel tank in each wing root. Total fuel capacity 85 litres (18.7 Imp. gallons).
ACCOMMODATION.—Two side-by-side seats in enclosed cabin, with jettisonable entrance door on each side. Dual controls.
DIMENSIONS.—
Span 9.87 m. (32 ft. 4 in.).
Length 6.30 m. (20 ft. 8 in.).
Height 2.18 m. (7 ft. 2 in.).
WEIGHTS AND LOADINGS.—
Weight empty 380 kg. (838 lb.).
Weight loaded 640 kg. (1,411 lb.).
Wing loading 52.5 kg./m.² (10.75 lb./sq. ft.).
Power loading 7.1 kg./h.p. (15.65 lb./h.p.).
PERFORMANCE.—
Max. speed 200 km.h. (125 m.p.h.).
Cruising speed 175 km.h. (109 m.p.h.).
Landing speed 75 km.h. (47 m.p.h.).
Ceiling 4,000 m. (13,125 ft.).
Range 700 km. (435 miles).
Endurance 4 hours.

THE SCHEIBE SPECHT (WOODPECKER).

The Specht is a tandem two-seat sailplane for dual instruction and solo training flights. It features the usual Scheibe construction with steel-tube fuselage and two-spar braced wooden wings of 14% Mü section. It has a mono-wheel landing gear and tail-skid.



Scheibe Sailplanes. Top left, the Bergfalke II/55 ; top right, the Zugvogel-III ; bottom left, the L-Spatz-55 ; and bottom right, the Specht.

The wings have an aspect ratio of 11, with a root chord of 1.35 m. (4 ft. 5 in.) and tip chord of 1.0 m. (3 ft. 3½ in.) and 2° of dihedral. Wing area is 16.64 m.² (179.1 sq. ft.).

DIMENSIONS.—
Span 13.50 m. (44 ft. 3½ in.).
Length 7.42 m. (24 ft. 4 in.).
Height 1.70 m. (5 ft. 7 in.).

WEIGHTS.—
Weight empty 210 kg. (463 lb.).
Weight loaded 390 kg. (860 lb.).

PERFORMANCE.—
Best glide ratio 20 : 1.
Min. sinking speed (two-seater) 0.87 m./sec. (2.85 ft./sec.).
Stalling speed 50 km.h. (31 m.p.h.).
Max. speed in still air 170 km.h. (106 m.p.h.).

THE SCHEIBE SPERBER (SPARROW-HAWK).

The Sperber is a development of the Specht sailplane and first flew on March 7, 1956. It is an enclosed side-by-side two-seat training glider of typical Scheibe construction, with steel-tube fuselage structure and braced wooden wings of 14% Mü section. It has a conventional mono-wheel landing gear and spring steel tail-skid.

The wings have an aspect ratio of 11.6 with a root chord of 1.35 m. (4 ft. 5 in.), tip chord of 0.94 m. (3 ft. 1 in.), and 2° of dihedral. Wing area is 17.40 m.² (187.3 sq. ft.).

DIMENSIONS.—
Span 14.20 m. (46 ft. 7 in.).
Length 7.4 m. (24 ft. 3 in.).
Height 1.40 m. (4 ft. 7 in.).

WEIGHTS.—
Weight empty 220 kg. (485 lb.).
Weight loaded 400 kg. (882 lb.).

PERFORMANCE.—
Best glide ratio 19 : 1.
Min. sinking speed (2 persons) 0.93 m./sec. (3.05 ft./sec.).
Stalling speed 48-54 km.h. (30-34 m.p.h.).
Max. speed in still air 170 km.h. (106 m.p.h.).

THE SCHEIBE BERGFALKE II/55.

Developed from the Mü 13E Bergfalke and the Bergfalke II, of which a total of more than 250 have been built, the Bergfalke II/55 is a tandem two-seat training and contest sailplane with swept-forward (4°) wings of 14.5% "Mü" section. It has a steel-tube fuselage and mono-wheel landing gear.

The single-spar wooden wings have an aspect ratio of 15.6, with a root chord of 1.51 m. (4 ft. 11 in.), tip chord of 0.65 m. (2 ft. 1½ in.) and 3.5° of dihedral. Wing area is 17.70 m.² (190.5 sq. ft.).

DIMENSIONS.—
Span 16.60 m. (54 ft. 6 in.).
Length 8.00 m. (26 ft. 3 in.).
Height 1.40 m. (4 ft. 7 in.).

WEIGHTS.—
Weight empty 250 kg. (551 lb.).
Weight loaded 440 kg. (970 lb.).

PERFORMANCE.—
Best glide ratio 28 : 1.
Min. sinking speed (2 persons) at 72 km.h. (44.7 m.p.h.) 0.72 m./sec. (2.36 ft./sec.).
Stalling speed 50-58 km.h. (31-36 m.p.h.).
Max. speed in still air 160 km.h. (99.5 m.p.h.).

THE SCHEIBE L-SPATZ-55 (SPARROW).

Developed from the Spatz-55, mainly by increasing the wing span to give a 10% improvement in performance, the L-Spatz-55 is a small lightweight single-seat sailplane suitable for training or competition flying. It has the usual Scheibe steel-tube fuselage and wooden single-spar wing structure. Aspect ratio is 19 and wing area 11.7 m.² (125.9 sq. ft.).

DIMENSIONS.—
Span 15.0 m. (49 ft. 3 in.).
Length 6.25 m. (20 ft. 6 in.).
Height 1.20 m. (3 ft. 11 in.).

WEIGHTS.—
Weight empty 155 kg. (342 lb.).
Weight loaded 265 kg. (584 lb.).

PERFORMANCE.—
Best glide ratio 29 : 1.
Min. sinking speed at 62 km.h. (38.5 m.p.h.). 0.64 m./sec. (2.01 ft./sec.).
Stalling speed 50 km.h. (31 m.p.h.).
Max. speed in still air 180 km.h. (112 m.p.h.).

THE SCHEIBE ZUGVOGEL.

The single-seat high-performance Zugvogel sailplane has a fabric-covered steel-tube fuselage and wooden single-spar wing and tail structures. The wings are swept-forward at 2.5° and have an NACA 63 series laminar-flow section.

Aspect ratio of the wings is 18.3, with a root chord of 1.20 m. (3 ft. 11 in.), tip chord of 0.48 m. (1 ft. 7 in.) and 2.4° of dihedral. Wing area is 13.95 m.² (150.16 sq. ft.).

DIMENSIONS.—
Span 16.0 m. (52 ft. 6 in.).
Length 7.4 m. (24 ft. 3 in.).
Height 1.58 m. (5 ft. 2 in.).

WEIGHTS.—
Weight empty 220 kg. (485 lb.).
Weight loaded 345 kg. (761 lb.).

PERFORMANCE.—
Best glide ratio 34 : 1.
Min. sinking speed at 65 km.h. (40.4 m.p.h.) 0.585 m./sec. (1.92 ft./sec.).
Stalling speed 55 km.h. (34 m.p.h.).
Max. speed in still air 200 km.h. (124 m.p.h.)

THE SCHEIBE ZUGVOGEL-III.

Latest development of the Zugvogel series of high-performance single-seat sailplanes is the Zugvogel-III, which made its first flight in April, 1957. It was developed through the Zugvogel-II, which differed from the original Zugvogel design by introducing an unswept wing of simpler construction, a more simple control system and other innovations.

The Zugvogel-III differs from the Zugvogel-II only by having an increased wing span and larger fin and rudder. It has the same type of construction and NACA 63 series wing section as its predecessors. Aspect ratio of the wings is 20, with a root chord of 1.20 m. (3 ft. 11 in.), tip chord of 0.40 m. (1 ft. 4 in.) and 2.5° of dihedral. Wing area is 14.48 m.² (155.9 sq. ft.).

DIMENSIONS.—
Span 17.0 m. (55 ft. 9 in.).
Length 7.10 m. (23 ft. 3½ in.).
Height 1.70 m. (5 ft. 7 in.).

WEIGHTS.—
Weight empty 245 kg. (540 lb.).
Weight loaded 365 kg. (805 lb.).

PERFORMANCE.—
Best glide ratio at 80 km.h. (50 m.p.h.). 35 : 1.
Min. sinking speed at 67 km.h. (41.6 m.p.h.) 0.58 m./sec. (1.90 ft./sec.).
Stalling speed 58 km.h. (36 m.p.h.).
Max. speed in still air 200 km.h. (124 m.p.h.).

SIEBEL

SIEBELWERKE-ATG, G.m.b.H.

HEAD OFFICE : ODEONSPLATZ 6, MUNICH.

First post-war design of the reconstituted Siebel company is a two-seat light aircraft known as the Si 222 Super-Hummel. It is a much-improved development of the Siebel Si 202 Hummel (Bumble-bee) of 1938, and is described hereafter.

Siebel is also a member of the Nordflug

group that is building the French Nord Noratlas transport aircraft under licence.

THE SIEBEL Si 222 SUPER-HUMMEL.

The Super-Hummel is a side-by-side two-seat light aircraft of conventional cantilever low-wing monoplane design. It is powered by a 90 h.p. Continental C90 - 12F four - cylinder horizontally-opposed air-cooled engine and has a fixed tail-wheel type landing gear, with cantilever main legs. The cabin is enclosed by a large transparent canopy, giving a 360° field of vision.

DIMENSIONS.—
Span 10.76 m. (35 ft. 4 in.).
Wing area 14 m.² (151 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 400 kg. (882 lb.).
Weight loaded 680 kg. (1,500 lb.).
Wing loading 48.6 kg./m.² (9.95 lb./sq. ft.).
Power loading 7.55 kg./h.p. (16.64 lb./h.p.).

PERFORMANCE.—
Max. speed 220 km.h. (137 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Landing speed 72 km.h. (44.7 m.p.h.).
Service ceiling 5,000 m. (16,400 ft.).
Take-off run 200 m. (655 ft.).
Landing run, with brakes 100 m. (328 ft.).
Range with 10% reserves 700 km. (435 miles).

WESERFLUG

"WESER" FLUGZEUGBAU G.m.b.H.

HEAD OFFICE: WERFTSTRASSE 158, BREMEN.

WORKS: LEMWERDER AND EINSWARDEN OLDENBURG.

Weserflug had its origin in a company formed in 1934 as a subsidiary of the A.G. "Weser" Bremen, one of the largest ship-building dock-yards in Germany. Pre-war, its development section was led by the late Dr. Rohrbach, the famous aircraft designer. During the war, it was engaged on building aircraft of Dornier, Focke-Wulf, Heinkel and Junkers design, as well as extensive repair and modification work.

The company was reconstituted in 1956 as the Finanz-und Verwaltungs-Gesellschaft "Weser" m.b.H., but reverted to its former name as the "Weser" Flugzeugbau G.m.b.H. early in 1957. Of the ten plants that were operated in 1945, only those at Lemwerder and Einswarden could be restored to operation. They have a total area of more than 1,000,000 sq. ft., to which is added the works of the Motorenwerk Varel G.m.b.H., at Varel in Oldenburg, a subsidiary of Weserflug.

With Hamburger Flugzeugbau and Siebelwerke A.T.G., Weserflug is building under licence the French Nord 2501 Noratlas transport for the Federal German Air Force. To handle this important contract, the three companies have formed a group under the name of Flugzeugbau-Nord G.m.b.H. at Hamburg. Weserflug's share of the work involves production of the centre-section of the Noratlas, complete with engine installation, landing gear and tail-booms. This work is done at Einswarden.

Under contract to the Federal Minister of Defence, Weserflug is also assembling and test flying 26 Vertol H-21 helicopters at Einswarden, for the German Air Force. This follows an earlier contract to de-cocoon and test fly 558 Republic F-84F and RF-84F aircraft; and Weserflug is expected to be made responsible for inspection, modification and repair of these types.

Weserflug is licenced by Vertol Aircraft Corporation to operate as sales representative of that country in Germany and to repair and overhaul all Vertol helicopters stationed in Europe, with the exception of those in France. The two companies hope also to co-operate on future development work.

In addition, Weserflug is expanding considerably its development department with the object of producing its own designs, with particular emphasis on transport aircraft.

THE GERMAN DEMOCRATIC REPUBLIC

Development of a nationalised aircraft industry in East Germany (die Volkseigene Luftfahrtindustrie der Deutschen Demokratischen Republik) began in 1954. Its activities are controlled by the State through the:—

VERWALTUNG DER LUFTFAHRTINDUSTRIE (Administration of the Aircraft Industry).

HEADQUARTERS: PIRNA (ELBE).
Director: Karl Patzold.
Technical Director: Prof. Dipl.-Ing. Brunolf Baade.

The aircraft industry comprises experimental and production works for passenger-carrying aircraft, gliders, aero-engines and instruments, as well as a number of research centres. All are State-owned.

As a start, the East German aircraft industry undertook production under licence of the Russian Ilyushin Il-14 airliner, under the designation of Il-14P. Production of this aircraft is handled by Industriewerk, Dresden-Klotsche, while its ASh-82T engines are built under licence by Industriewerk Karl Marx Stadt, Chemnitz.

A nationally-designed (by Professor Dipl.-Ing. Baade) four-jet airliner, the BB-152, is understood to be in an advanced stage of construction and it has been reported that a production batch of one hundred is to be completed within three years.

A helicopter designed and built by the state industry was flown for the first time in 1956, but no details of this are available.

Before development of powered aircraft began, aviation activities in East Germany were confined to gliding. The first gliding clubs were formed in 1950, and were officially organised two years later. Modified versions of three pre-war sailplanes, the SG-38, the Grunau Baby IIb and the Miesse, were placed in production, and at the same time a few high-performance sailplanes of the Mucha (Polish), Sohaj (Czech) and Pionyr (Czech) types were obtained from neighbouring countries to augment the equipment of the clubs.

The first nationally-designed glider, the Patriot, appeared in 1954 but it was not successful and was subsequently abandoned.

In 1955 three new aircraft were heard of—a two-seat training and sporting glider designated FES 530, which was flown at the beginning of 1956 and is now in series production; and the La-16 and La-17 powered gliders designed by Professor Landmann of the Technical High School in Dresden. An experimental glider, the VOX-1 designed by Professor Vogel, was completed at the end of 1955. This glider was provided with flapping wing-tips which were operated by muscle-power provided by the pilot's legs.

Some advanced types of gliders are under development and a prototype of a new high-performance sailplane, the LOM-55 Libelle, was exhibited, along with a Dresden-built Il-14P airliner, at the Leipzig Trade Fair in March, 1957.



The Industriewerk IL-14P Transport (two licence-built ASh-82T engines).



The Industriewerk IL-14P Transport (two licence-built ASh-82T engines)

For its recently-formed air defence force East Germany is obliged to rely on the Soviet Union for the supply of equipment. Yak-11 and Yak-18 airscrew-driven aircraft have been supplied for training, and it was reported in the summer of 1957 that the first MiG-19 twin-jet interceptors had been received. MiG-15 fighters and MiG-15 UTI training aircraft are also in service.

THE INDUSTRIEWERK IL-14P.

The Il-14P is being built under a Soviet licence for domestic use and for export. The basic design has accommodation for a crew of five and 18 passengers, but a 26-passenger version and an executive model are also available.

Increase in payload has been obtained by the extensive use of lightweight materials, resulting in a saving of approximately 800 kg. (1,760 lb.) on the empty weight.

TYPE.—Twin-engined Transport.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 10. T/c ratio 18% at root, 12% at tip. Mean chord 3.412 m. (11 ft. 2 in.). Dihedral 3° on centre-section, 3° 30′ on outer wings. Incidence 2°. All-metal three-spar structure in three portions, with outer wings bolted to centre-section. Fabric-covered ailerons and slotted flaps. Hot-air de-icing. Wing area 100 m.² (1,076 sq. ft.).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal construction. Fin integral with fuselage. Rudder fabric-covered. Hot-air de-icing of fin and tailplane leading edges. Areas: vertical surfaces 12.6 m.² (135.6 sq. ft.), horizontal surfaces 21.32 m.² (229.5 sq. ft.). Tailplane span 9.25 m. (30 ft. 4 in.).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Single nose-wheel retracts rearward into fuselage. Main units, each with twin wheels, retract forward into engine nacelles. Main wheels 840 × 300 mm. Nose-wheel 770 × 330 mm. Brakes on main wheels. Wheel track 7.70 m. (25 ft. 3 in.). Wheelbase 5.37 m. (17 ft. 7½ in.).

POWER PLANT.—Two ASh-82T fourteen-cylinder radial air-cooled engines, developing 1,900 h.p. at 2,600 r.p.m. for take-off and with rated power of 1,630 h.p. at 2,400 r.p.m. at 1,600 m. (5,250 ft.). Four-blade A.W.50 metal constant-speed feathering airscrews, diameter 3.8 in. (12 ft. 6 in.). Engines built up as quickly-interchangeable complete power plants. Fuel in eight tanks in outer wings, with total capacity of 3,500 litres (770 Imp. gallons).

ACCOMMODATION.—Side-by-side seats for pilot and co-pilot on flight deck, with folding seat for flight engineer aft. Adjoining cabin for radio operator. Main cabin accommodates 18 or 26 passengers, with alternative *de-luxe* layouts also available. Cloak-room and toilet to rear of main cabin. Baggage and freight compartments forward and rear of main cabin. Rear starboard passenger door.

EQUIPMENT.—Three radio installations. Automatic pilot. Night and blind-flying equipment. De-icing and fire-extinguishing systems.

DIMENSIONS.—
- Span 31.70 m. (104 ft.).
- Length 21.31 m. (69 ft. 11 in.).
- Height 7.90 m. (25 ft. 11 in.).

WEIGHTS (18-passenger version).—
- Weight empty (equipped) 12,000 kg. (26,455 lb.).
- Disposable load 4,500 kg. (9,920 lb.).
- Weight loaded 16,500 kg. (36,375 lb.).

PERFORMANCE.—
- Max. speed 430 km.h. (267 m.p.h.).
- Max. cruising speed at 3,000 m. (9,850 ft.) 347 km.h. (216 m.p.h.).
- Economical cruising speed 320 km.h. (199 m.p.h.).
- Service ceiling 7,000 m. (22,965 ft.).
- Take-off run approx. 470 m. (1,540 ft.).
- Take-off distance to 25 m. (82 ft.) approx. 1,020 m. (3,345 ft.).
- Landing run approx. 430 m. (1,410 ft.).
- Landing distance from 25 m. (82 ft.) approx. 860 m. (2,820 ft.).
- Stage length at 320 km.h. (199 m.p.h.) at 2,000 m. (6,560 ft.) with 18 passengers and 3,000 litres (660 Imp. gallons) fuel 2,150 km. (1,335 miles).
- Stage length at 320 km.h. (199 m.p.h.) at 2,000 m. (6,560 ft.) with 26 passengers and 2,100 litres (462 Imp. gallons) fuel, with reserves for one hour, 1,500 km. (932 miles).

THE LANDMANN La-16 LERCHE.

The La-16, which was designed by Professor Landmann, was originally flown as a glider but subsequently a light pusher engine was fitted. The powered version crashed on one of its early flights and was damaged.

The La-16 is a single-seat mid-wing cantilever monoplane of all-wood construction, a new weight-saving glueing process being used in its building.

The wings, which have air-brakes on the upper surfaces, have down-turned tips which serve as stabilising skids, the actual landing-gear consisting only of a single semi-retractable wheel under the fuselage and a tail-skid. The tail-unit is of the strut-braced "butterfly" type.

The power plant consists of an 18 h.p. Kroeber M-4 two-cylinder horizontally-opposed air-cooled two-stroke engine. It is mounted above the fuselage behind the cockpit and drives the pusher propeller through an extension shaft.

DIMENSIONS.—
- Span 12.5 m. (41 ft.).
- Length 6.42 m. (21 ft.).
- Height 2.1 m. (6 ft. 8¾ in.).
- Wing area 12.5 m.² (134.5 sq. ft.).

WEIGHTS.—
- Weight empty 174 kg. (383 lb.).
- Weight loaded 275 kg. (605 lb.).

PERFORMANCE (estimated).—
- Max. speed 138 km.h. (86 m.p.h.).
- Rate of climb 102 m./min. (335 ft./min.).
- Min. sinking speed (power off) 0.85 m./sec. (2.79 ft./sec.).
- Fineness ratio 19.5.

THE LANDMANN La-17.

The La-17 was, at the time of writing, being built by the students of the Dresden Technical High School under the supervision of Professor Landmann.

It is a two-seat powered glider of all-wood construction. The wings, with dihedral at their inner ends, are attached to a centre-section which is mounted on top of the nacelle, and are braced on either side by struts.

The landing gear consists of a single wheel under the nacelle and a tail-skid, formed by the bottom of the fin. Supplementary skids are attached to the wing-tips.

The cruciform-type tail-unit is carried on booms springing from the extremities of the centre-section and from the base of the nacelle.

The open cockpit with side-by-side seating is in front of the wing leading-edge. The seats are staggered, with the starboard seat slightly to the rear of the port, or pilot's seat.

The power-plant consists of a BK-350 two-cylinder two-stroke engine rated at 17 h.p. at 5,000 r.p.m. The engine is



The FES 530 two-seat Training Glider.

mounted on top of the centre-section and drives a two-blade pusher airscrew through an extension shaft.

WEIGHT (estimated).—
Weight loaded 450 kg. (990 lb.).

PERFORMANCE.—
No data.

THE FES 530.

The FES 530 two-seat training and sporting glider was subjected to extensive flight and ground testing in 1956. Frequent flights of two to four hours as a two-seater and of over six hours as a single-seater were made. Structural tests showed that the airframe has a safety factor of 8.5. As a result of the success of the test programme, the FES 530 was put into quantity production.

TYPE.—Two-seat Training Glider.

WINGS.—Braced high-wing monoplane. Wing section Gö 549 at root, Gö 676 at tip. Aspect ratio 15.2. Chord 1.80 m. (5 ft. 11 in.) at root, 0.45 m. (1 ft. 6 in.) at tip. Dihedral 2°. Single-spar wooden structure in two sections, with fabric covering. Wing-to-fuselage fixings can be disconnected by a single lever movement. Air brakes on undersurface linked with spoilers on top surface. Total area of ailerons 2.6 m.² (27.99 sq. ft.). Gross wing area 19 m.² (204.5 sq. ft.).

FUSELAGE. — Wood structure, plywood-covered.

TAIL UNIT.—Monoplane type. Wooden structure. Tailplane and fin plywood-covered. Elevator and rudder fabric-covered. Trim-tab in elevator. Fin integral with fuselage. Areas: horizontal surfaces 2.85 m.² (30.68 sq. ft.), vertical surfaces 1.46 m.² (15.71 sq. ft.).

LANDING GEAR.—Rubber-sprung skid and sprung mono-wheel. Auxiliary tail-skid with tennis ball shock-absorption.

ACCOMMODATION.—Two seats in tandem under hinged and removable Plexiglas canopy. Rear seat slightly raised to improve forward view.

DIMENSIONS.—
Span 17.00 m. (55 ft. 9 in.).
Length 7.95 m. (26 ft. 1 in.).
Height 2.12 m. (6 ft. 11 in.).

WEIGHTS AND LOADING.—
Weight equipped 300 kg. (661 lb.).
Weight loaded 480 kg. (1,058 lb.).
Wing loading 25.25 kg./m.² (5.17 lb./sq. ft.).



The LOM-55 Libelle Single-seat High-Performance Sailplane.

PERFORMANCE.—
Best glide ratio 24 : 1 at 85 km.h. (53 m.p.h.).
Min. sinking speed 0.85 m./sec. (2.79 ft./sec.) at 72 km.h. (45 m.p.h.).
Max. towing speed by winch or car 100 km.h. (62 m.p.h.).
Max. aero-tow speed 130 km.h. (81 m.p.h.).
Max. permissible diving speed 200 km.h. (124 m.p.h.).

THE LOM-55 LIBELLE.

The Libelle is a single-seat high-performance sailplane suitable for simple aerobatics. Flight trials began early in 1957 and simultaneous structural tests showed that the airframe has a safety factor of 10. The Libelle is in series production.

TYPE. —Single-seat High-performance sailplane.

WINGS.—Cantilever mid-wing monoplane type. Gö 549 wing section. Aspect ratio 18.35. Chord 1.20 m. (3 ft. 11 in.) at root, 0.60 m. (1 ft. 11½ in.) at tip. Dihedral 3°. Single-spar wood structure in two parts, with plywood covering forward of spar and fabric covering aft. Air brakes on under-surface linked with spoilers on top surface. Tanks in wings for water ballast which can be released in flight. Wing area 14.85 m.² (159.85 sq. ft.).

FUSELAGE.—Wood construction in two portions. Forward portion wood structure with plywood covering. Circular-section monocoque tail-boom.

TAIL UNIT.—Cantilever "butterfly" Vee tail surfaces of wood construction with plywood-covered fixed surfaces and fabric-covered movable surfaces, including trim-tab. Surfaces fold upward for transport. Alternative cruciform tail surfaces under development.

LANDING GEAR.—Retractable sprung mono-wheel with brake. Rubber-sprung fore and aft skids.

ACCOMMODATION.—Single seat under jettisonable canopy.

DIMENSIONS.—
Span 16.50 m. (54 ft. 2 in.).
Length 6.15 m. (20 ft. 2 in.).
Height (tailplane folded up) 1.95 m. (6 ft. 5 in.).

WEIGHTS AND LOADING.—
Weight equipped 240 kg. (529 lb.).
Weight loaded 330 kg. (728 lb.).
Wing loading 22.2 kg./m.² (4.55 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio approx. 32 : 1 at 80 km.h. (50 m.p.h.).
Min. sinking speed 0.62 m./sec. (2.03 ft./sec.) at 63 km.h. (39 m.p.h.).
Landing speed 57 km.h. (35.4 m.p.h.).
Max. towing speed by winch 100 km.h. (62 m.p.h.).
Max. aero-tow speed 130 km.h. (81 m.p.h.).
Max. permissible diving speed 240 km.h. (149 m.p.h.).

HUNGARY

When the war ended no aircraft manufacturing facilities remained in Hungary. The German armies dismantled and removed all plant and equipment when they evacuated the country.

In recent years the Országos Magyar Repülö Egyesület (National Hungarian Aeronautical Association) has played a part in the encouragement of the manufacture of light aircraft of national design, the most important constructional establishment being the Sportarutermelö N.V., or national concern for the production of sporting equipment, which has an aircraft factory at Esztergom.

This factory builds light aircraft and gliders to the designs of Engineer Ernö Rubik. Among the principal Rubik designs are the R.14 Pinty (Finch), the R.15 Koma (Godfather) and R.16 Lepke (Butterfly), the last two being training gliders, the R.17 Móka (Joy) aerobatic sailplane, the R.18 Kánya (Kite) glider-tug and the R.22 Futár (Courier) sailplane.

Other current designs are the M.30 Fergeteg sailplane, the SG.2 Kék Madár (Blue Bird) two-seat light monoplane designed by Samu and Geönczy; the Botond two-seat trainer designed by Nagy and Cserkuti; the Nádi training glider designed by Nagy; the Bene training glider designed by Nagy in collaboration with Bansagi; the Pajtás (Comrade) designed by Lampich; and the Lurko designed by Burodics. All these aircraft have been described in previous editions of "All The World's Aircraft."

The most recent sailplane designs are the OE-01, the Junius 18 and the all-metal Györ II which has a fineness ratio of 42.85.

INDONESIA

ANGKATAN UDARA REPUBLIK INDONESIA, STAF TEKNIK, DEPOT PERAWATAN TEKNIK UDARA, SEKSI PERTJOBAAN (Indonesian Air Force, Technical Staff, Aircraft Maintenance Depot, Experimental Section).

ADDRESS : HUSEIN SASTRANAGARA AIR FORCE BASE, BANDUNG, JAVA.

Director : Major Nurtanio Pringgoadisuryo, B.Sc.(Ae.).

This is now the only facility in Indonesia which is building aircraft.

In 1946 Major Nurtanio designed and built a batch of six gliders of the "Zögling" type. These were built entirely of Indonesian materials, the import of foreign materials being impossible at that time. These gliders have served successfully as trainers for the pre-engined flight selection of Air Force cadets.

In 1947 Air Vice-Commodore Wiweko Supono designed and built the WEL-1 single-seat parasol monoplane powered by a 28 h.p. Harley-Davidson motorcycle engine. In spite of the difficulty of obtaining materials, the construction of this aircraft took only five months from the drawing board to the first test flight.

Both these types were built in the Air Force workshops at the Maospati Air Force Base, Madiun, Java.

In 1950 the Indonesian Air Force took over the former workshops of the Netherlands Indies Army Air Service in Bandung, Java.

In 1953 Major Nurtanio Pringgoadisuryo began the design of the NU-200 Sikumbang. The prototype made its first flight on August 1, 1954. The NU-200 has been described and illustrated in previous editions.

As the result of experience with the NU-200, an improved version known as the NU-225 has been built, brief details of which follow.

THE NU-225 SIKUMBANG (BEE).

TYPE.—Single-seat light Ground Support monoplane.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 23015 at root, NACA 23009 at tip. Aspect ratio 6.6. Dihedral 5°. Incidence 4.5°. One-piece two-spar all-wood construction with plywood covering. Mechanically-operated all-wood plywood - covered landing flaps. Statically-balanced ailerons. Gross wing area 182 sq. ft. (16.9 m.²).

FUSELAGE.—Welded steel-tube structure with metal covering.

TAIL UNIT.—Cantilever all-wood plywood covered monoplane type. Fin mounted forward of tailplane. Trim-tabs in rudder and elevator. Areas : fin 9.9 sq. ft. (0.92 m.²), rudder 8.7 sq. ft. (0.80 m.²), tailplane 19.2 sq. ft. (1.78 m.²), elevators 16.8 sq. ft. (1.56 m.²). Span of tailplane 11 ft. 2½ in. 3.42 m.).

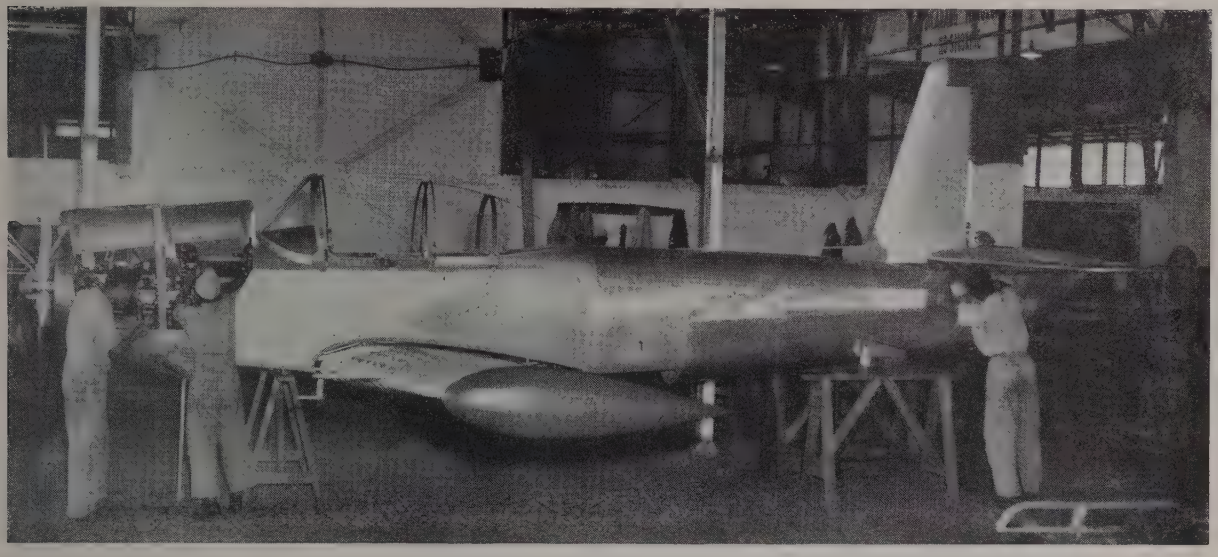
LANDING GEAR.—Retractable tricycle type. Cantilever oleo shock-absorber struts.

POWER PLANT.—One 225 h.p. Continental O-470-A six-cylinder horizontally-opposed air-cooled engine driving a Hartzell metal constant-speed airscrew. One fuel tank in each wing root and one tank in fuselage behind pilot's seat. Auxiliary fuel in wing-tip tanks.

ACCOMMODATION.—Single cockpit with sliding canopy.

DIMENSIONS.—
Span 34 ft. 9½ in. (10.61 m.).
Length 26 ft. 9 in. (8.16 m.).
Height 11 ft. (3.35 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The NU-225 Sikumbang being assembled in the Indonesian Air Force Workshops at Bandung.

ITALY

AERFER

INDUSTRIE MECCANICHE AERONAUTICHE MERIDIONALI-AERFER.

HEAD OFFICE: 30, CORSO MALTA, NAPLES.

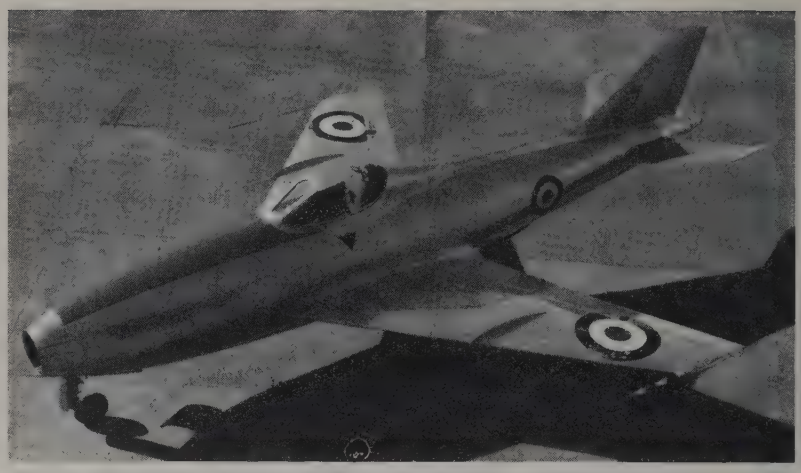
WORKS: POMIGLIANO D'ARCO; CAPODICHINO AIRPORT, NAPLES; AND NAPLES VASTO.

General Manager and Managing Director: Dr. Ing. Amedeo Carassai.

Formed in 1955, the Industrie Meccaniche Aeronautiche Meridionali-Aerfer comprises factories which formerly belonged to Officine di Pomigliano per Costruzioni Aeronautiche e Ferroviarie Aerfer, founded in 1949, and to Industrie Meccaniche ed Aeronautiche Meridionali, builders of the wartime RO-37, RO-41 and RO-57 aircraft.

Aerfer is engaged on the production, overhaul and reconditioning of both jet and piston-engined aircraft. It is manufacturing spare parts for the Republic F-84G and F-84F under licence; and is developing the Sagittario 2 and Ariete light fighters designed by Ing. Sergio Stefanutti.

A later project, in the initial design stage, is the Aerfer Leone (Lion) mixed-power interceptor, with a de Havilland Gyron Junior turbojet and de Havilland Spectre rocket-engine.



The Aerfer Sagittario 2 (Rolls-Royce Derwent turbojet engine).

THE AERFER SAGITTARIO (ARCHER) 2.

The Sagittario 2 is an all-metal development of the Sagittario 1 research aircraft, which was built by the Ambrosini company and was described in the 1954-55 edition of "All the World's Aircraft."

Designed for both tactical support and interception duties, the Sagittario 2 made its first flight in June, 1956 and later reached a speed of Mach 1.1 during a dive from 13,700 m. (45,000 ft.) although it is powered with a Rolls-Royce Derwent 9 turbojet engine of only 1,633 kg. (3,600 lb.) s.t. From it is being developed the Aerfer Ariete lightweight fighter.

TYPE.—Single-seat Tactical Support and Day Interceptor Fighter.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 3.82. Sweepback 41° at ¼-chord line. All-metal stressed skin structure. Statically and dynamically balanced slotted ailerons operated through Fairey hydraulic powered controls with manual reversion. All-metal plain flaps, hydraulically operated. Gross wing area 14.73 m.² (158.55 sq. ft.).

FUSELAGE.—All-metal structure in two quickly detachable sections. Underside covered with an air-cooled sheet of stainless steel to prevent damage by exhaust efflux. Fin integral with fuselage. Two hydraulically operated and mechanically interconnected air brakes on sides of rear fuselage.

TAIL UNIT.—All-metal structure with one-piece hydraulically operated variable incidence "flying" tailplane.

LANDING GEAR.—Retractable tricycle type. Dowty liquid spring shock absorbers. Hydraulic retraction. Dunlop wheels and brakes.

POWER PLANT.—One Rolls-Royce Derwent 9 turbojet engine (1,633 kg.=3,600 lb. s.t.) mounted in fuselage nose, with jet-pipe carried down to exhaust under fuselage. Fuel in four rubber tanks in fuselage with total capacity of 1,200 litres (264 Imp. gallons).

ACCOMMODATION.—Single seat in pressurised cockpit with jettisonable canopy. Martin-Baker Mk. 4 lightweight fully-automatic ejector seat. Air-conditioning and pressure-breathing oxygen systems. Manually-opened canopy.

ARMAMENT.—Two 30 mm. guns in fuselage. Provision for carrying 2×225 kg. (500 lb.) bombs, 2×315 kg. (700 lb.) napalm tanks, two additional guns or 12×7.62 cm. (3 in.) rockets under wings.

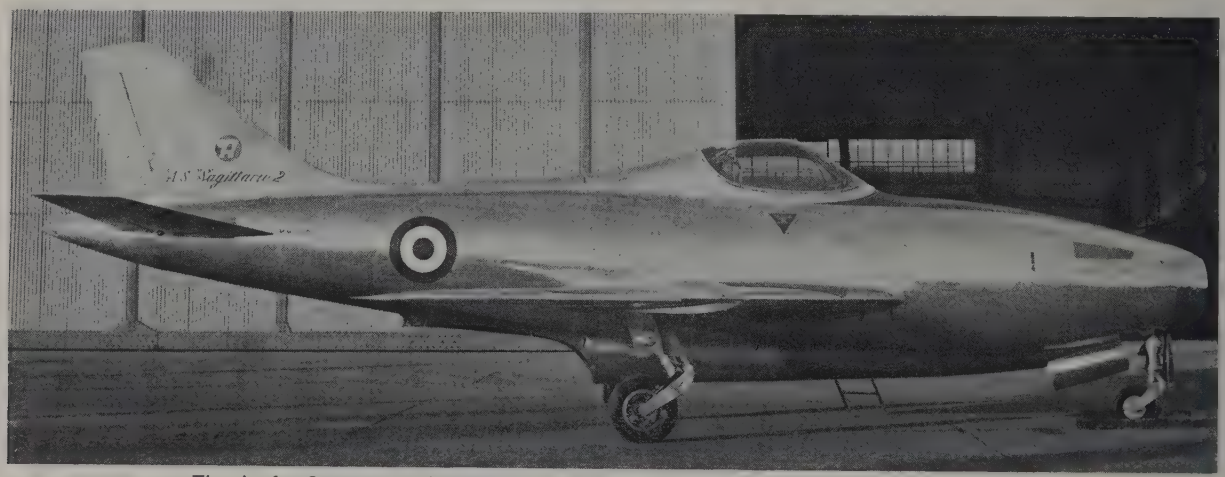
DIMENSIONS.—
Span 7.50 m. (24 ft. 7 in.).
Length 9.50 m. (31 ft. 2 in.).
Height 2.02 m. (6 ft. 8 in.).

WEIGHT AND LOADINGS.—
Weight loaded 3,293 kg. (7,260 lb.).
Wing loading 227 kg./m.² (46.5 lb./sq. ft.).
Power loading 0.91 kg./h.p. (2.02 lb./h.p.).

PERFORMANCE.—
Max. speed 1,006 km.h. (625 m.p.h.).
Rate of climb at S/L. 2,530 m./min. (8,300 ft./min.).
Time to 12,000 m. (39,370 ft.) 10 min.
Service ceiling 14,000 m. (46,000 ft.).
Take-off distance 450 m. (1,470 ft.).
Landing distance 500 m. (1,640 ft.).

THE AERFER ARIETE (BATTERING RAM).

The Ariete lightweight fighter is a development of the Sagittario 2, from which it differs by the addition of a Rolls-Royce Soar auxiliary turbojet for improved take-off, climb and combat performance. No further details are available for publication.



The Aerfer Sagittario 2 Single-seat Light Tactical Support and Day Interceptor Fighter.

AGUSTA

COSTRUZIONI AERONAUTICHE GIOVANNI AGUSTA.

HEAD OFFICE: CASCINA COSTA, GALLARATE.

President and General Manager: Comm. Domenico Agusta.

Deputy General Manager: Dr. Mario Agusta.

Chief Designer: Dr. Filippo Zappata.

This company was established in 1923 by Giovanni Agusta. It built numerous experimental and production aircraft before the war and, despite post-war difficulties, has succeeded in re-establishing itself in the aircraft manufacturing field.

In 1952 Agusta obtained the exclusive manufacturing rights in Europe for the Bell Model 47 helicopter and the first Agusta-built Model 47G made its maiden flight on May 22, 1954.

During 1955 the company delivered more than 80 Model 47G and 47G2 helicopters to civil and military customers in Italy, France, Great Britain, Sweden, Switzerland and Austria.

Agusta is also licenced to manufacture all spare parts for Bell helicopters for the whole of Europe.

Dr. Filippo Zappata has prepared for Agusta various designs for transport aircraft for both civil and military purposes, and the Italian Air Ministry has awarded the company a contract to build a prototype of the 22/26-seat Agusta

Model AZ-8L civil transport. Details of this aircraft follow hereafter :—

THE AGUSTA AZ-8L.

TYPE.—Four-engined Medium-range Transport.

WINGS.—Low-wing cantilever monoplane. Aerofoil section Z.3. Aspect ratio 9.76. Chord 3.22 m. (10 ft. 7 in.) at root, 1.64 m. (5 ft. 5 in.) at tip. Dihedral 8½°. Incidence 3°. Single-spar all-metal stressed-skin structure. Frise-type ailerons. Slotted flaps. Total area of ailerons 8.20 m.² (88.26 sq. ft.). Total area of flaps 11.20 m.² (120.56 sq. ft.). Gross wing area 66.80 m.² (719 sq. ft.).

FUSELAGE.—All-metal monocoque structure.

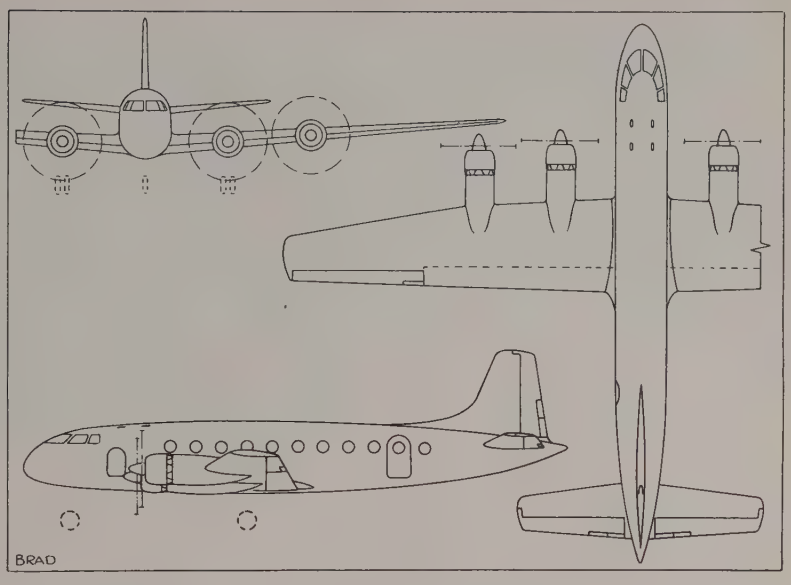
TAIL UNIT.—Cantilever monoplane type. All-metal structure, including covering of movable surfaces. Fin area 4.10 m.² (44.12 sq. ft.), rudder area 2.30 m.² (24.75 sq. ft.), tailplane area 7.0 m.² (75.32 sq. ft.), elevator area 4.10 m.² (44.12 sq. ft.). Tailplane span 8.72 m. (28 ft. 7 in.).

LANDING GEAR.—Retractable tricycle type. Each main unit has twin wheels and single shock strut. Steerable nose unit has single wheel. Hydraulic retraction. Dual hydraulic brakes on each main wheel. Track 5.80 m. (19 ft.). Wheelbase 6.55 m. (21 ft. 5¾ in.).

POWER PLANT.—Four Alvis Leonides Mk. 22 (503/2) nine-cylinder radial air-cooled engines, each developing 470 h.p. at maximum continuous cruise and with 540 h.p. available for take-off. D.H. three-blade constant-speed feathering airscrews, 9 ft. (2.74 m.) diameter. All fuel tanks in wings. Normal fuel capacity 3,200 litres (700 Imp. gal.). One 45 litre (10 Imp. gal.) oil tank in each nacelle.

ACCOMMODATION.—Crew of two, consisting of pilot and co-pilot/radio operator. Dual controls. Cabin, which is sound-proofed, air-conditioned and heated, accommodates up to 22 passengers. Forward baggage compartment has volume of 2.10 m.³ (74 cub. ft.), aft baggage compartment a volume of 3.40 m.³ (120 cub. ft.).

DIMENSIONS.—
Span 25.50 m. (83 ft. 8 in.).
Length 19.44 m. (63 ft. 9 in.).
Height 6.60 m. (21 ft. 8 in.).



The Agusta AZ-8L Transport.

WEIGHTS.—
Equipped weight, including crew, fuel, etc. 7,300 kg. (16,094 lb.).
Payload 3,500 kg. (7,716 lb.).
Max. loaded weight 10,800 kg. (23,810 lb.).

PERFORMANCE (Estimated, at loaded weight of 10,600 kg. = 23,370 lb.).—
Cruising speed, max. cont. power at 3,000 m. (9,850 ft.) 405 km.h. (252 m.p.h.).
Cruising speed, recommended power at 3,000 m. (9,850 ft.) 370 km.h. (230 m.p.h.).
Max. rate of climb at S/L. flaps up 300 m./min. (985 ft./min.).
Ceiling 7,500 m. (24,600 ft.).
Take-off distance to 15.25 m. (50 ft.) at S/L. 590 m. (1,935 ft.).

THE AGUSTA AZ-8S.

The AZ-8S will be identical to the AZ-8L except that it will be powered by four 575 h.p. SNECMA 12S twelve-cylinder inverted Vee air-cooled engines.

THE AGUSTA-BELL MODEL 47.

Agusta is building under licence the Bell Model 47G helicopter with the Franklin 6V4-200-C22 engine ; the Model 47G-2 with the Lycoming V0-435-A1B engine, derated to 200 h.p. and with hydraulically-boosted controls ; and the Model 47J with the Lycoming V0-435 engine derated to 220 h.p. and with hydraulic boost control and aerodynamic streamlining.

General structural details and dimensions of all these models will be found under "Bell" (U.S.A.).

The weight and performance data of the Agusta-Bell 47J are as follows :—

WEIGHTS.—
Weight empty 697.6 kg. (1,538 lb.).
Weight loaded 1,163.5 kg. (2,565 lb.).

PERFORMANCE (at 1,163.5 kg. — 2,565 lb. A.U.W.).—
Max. allowable speed 169 km.h. (105 m.p.h.).
Cruising speed 140 km.h. (87 m.p.h.).
Max. rate of climb at S/L. 216 m./min. (710 ft./min.).
Time to 1,525 m. (5,000 ft.) 6 min. 18 sec.
Service ceiling 3,978 m. (13,050 ft.).
Absolute ceiling 4,420 m. (14,500 ft.).
Hovering ceiling in ground effect 2,240 m. (7,350 ft.).
Range 309 km. (192 miles).
Endurance 2 hr. 37 min.



The Agusta-Bell Model 47 Helicopter.

AMBROSINI

SOCIETA' AERONAUTICA ITALIANA, ING. A. AMBROSINI & C.

REGISTERED OFFICE : VIA PALESTRO 68, ROME.

HEAD OFFICE : VIALE MAINO 23, MILAN.

AIRCRAFT WORKS : PASSIGNANO SUL TRASIMENO (PERUGIA).

AERODROME : CASTIGLION DEL LAGO.

Chairman and Managing Director : Ing. Angelo Ambrosini.

Aircraft Designer : Prof. Ing. Ermenegilda Preti.

The Societa Aeronautica Italiana was incorporated into the Ambrosini group in 1934. Since that time a long series of touring and training aircraft have been designed and built.

The company's first post-war types were the S.1001 Grifo four-seat touring and training monoplane, and a two-seat primary trainer development of the Grifo known as the S.1002 Trasimenus.

They were followed by the Ambrosini S.7 military trainer and the slightly larger and more powerful Super S.7, both of which were produced in small series for the Italian Air Force.

All of these aircraft have been fully described and illustrated in previous editions of "All the World's Aircraft."

Ambrosini's production at present is centred mainly on the F.7 Rondone, a three-seat light cabin monoplane with alternative Continental C.90 and Lycoming O-290-D2 engine. The company is also building the prototype of an *ab initio* jet trainer known as the Ambrosini P.18 and has in hand design studies of various types of civil aircraft.

THE AMBROSINI P.18.

TYPE.—Two-seat *ab initio* Jet Trainer.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 7. All-metal structure. Total area of ailerons 1.214 m.² (13.06 sq. ft.). Total area of flaps 1.682 m.² (18.10 sq. ft.). Wing area 14 m.² (150.7 sq. ft.).

FUSELAGE.—All-metal structure, with jet exhaust under tail-boom.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas : fin 0.904 m.² (9.73 sq. ft.), rudder 0.609 m.² (6.56 sq. ft.), tailplane 1.445 m.² (15.55 sq. ft.), elevators 1.045 m.² (11.25 sq. ft.).

LANDING GEAR.—Retractable tricycle type.

POWER PLANT.—One 400 kg. (880 lb.) s.t. Turbomeca Marboré II turbojet engine mounted in fuselage under wing. Provision for engines of greater thrust.

ACCOMMODATION.—Two seats side-by-side under large transparent canopy.

DIMENSIONS.—
Span 9.90 m. (32 ft. 6 in.).
Length 7.50 m. (24 ft. 7 in.).
Height 2.90 m. (9 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 700 kg. (1,543 lb.).
Weight loaded 1,300 kg. (2,866 lb.).
Wing loading 93 kg./m.² (19.05 lb./sq. ft.).
Power loading 3.25 kg./kg. s.t. (3.25 lb./lb. s.t.).

PERFORMANCE (estimated).—
Max. speed at S/L. 543 km.h. (337 m.p.h.).
Cruising speed (max. continuous power) at S/L. 469 km.h. (291 m.p.h.).

Cruising speed (max. continuous power) at 6,000 m. (19,700 ft.) 508 km.h. (316 m.p.h.).
Min. speed without flaps 114 km.h. (71 m.p.h.).
Min. speed with flaps 93 km.h. (58 m.p.h.).
Rate of climb at S/L. 845 m./min. (2,770 ft./min.).
Rate of climb at 6,000 m. (19,700 ft.) 365 m./min. (1,188 ft./min.).
Time to 2,000 m. (6,560 ft.) 3 min. 24 sec.
Time to 4,000 m. (13,120 ft.) 7 min. 15 sec.
Time to 6,000 m. (19,700 ft.) 11 min. 54 sec.

THE AMBROSINI F.7 RONDONE.

TYPE.—Three/four-seat Light Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.60. All-wood one-piece single-spar structure, plywood covering. Differentially-controlled ailerons. Two-position flaps, 15° for take-off and 45° for landing. Gross wing area 10.00 m. (114 sq. ft.).

FUSELAGE.—All-wood monocoque structure in two sections, the forward section integral with wing.

TAIL UNIT.—Cantilever monoplane type. All-wood structure, fixed surface covered with plywood, rudder and elevators covered with fabric. Controllable trim-tab in elevator.

LANDING GEAR.—Retractable tricycle type. Manual actuation, but electric actuator may be installed on demand. Oleo-pneumatic shock-absorber struts. Hydraulic wheel brakes.

POWER PLANT.—One 90 h.p. Continental C90 four-cylinder horizontally-opposed air-cooled engine. Two-blade Aeromatic automatic variable-pitch airscrew. Alternatively, the 135 h.p. Lycoming O-290-D2 engine or any other engine of similar power can be fitted. These would drive a two-blade fixed-pitch airscrew. Three fuel tanks, two in front of instrument board and one behind passenger seat. Total capacity 142 litres (31 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating three, side-by-side with dual controls and one in seat behind pilot on port side, leaving space for baggage on starboard side. If 125-135 h.p. engine installed a bench-type seat for two can be fitted at back of cabin. Full instrument equipment, VHF 12-channel transmitter and receiver, night-flying lighting, etc.

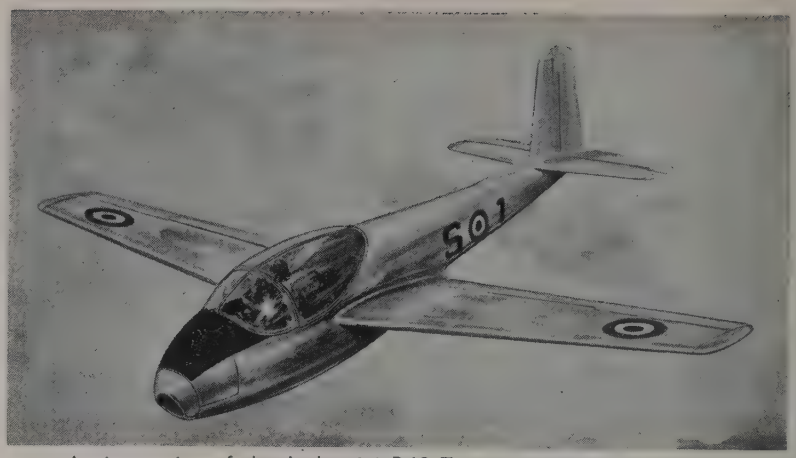
DIMENSIONS.—
Span 9.30 m. (30 ft. 6 in.).
Length 6.80 m. (22 ft. 4 in.).

WEIGHTS AND LOADINGS (3-seater—90 h.p. Continental C90 engine).—
Weight empty 480 kg. (1,056 lb.).
Pilot and 2 passengers 225 kg. (495 lb.).
Fuel and oil 55 kg. (110 lb.).
Baggage 10 kg. (22 lb.).
Weight loaded 770 kg. (1,694 lb.).
Wing loading 58.5 kg./m.² (12.0 lb./sq. ft.).
Power loading 6.8 kg./h.p. (14.9 lb./h.p.).

WEIGHTS AND LOADINGS (4-seater—135 h.p. Lycoming engine).—
Weight empty 530 kg, (1,166 lb.).
Pilot and 3 passengers 300 kg. (660 lb.).
Fuel and oil 70 kg. (154 lb.).
Weight loaded 900 kg. (1,980 lb.).
Wing loading 68 kg./m.² (13.9 lb./sq. ft.).
Power loading 9.5 kg./h.p. (20.9 lb./h.p.).

PERFORMANCE (90 h.p. Continental C90 engine).—
Max. speed 235 km.h. (150 m.p.h.).
Min. speed 70 km.h. (43.5 m.p.h.).
Ceiling 3,800 m. (12,460 ft.).
Range (3-seater) 650 km. (405 miles).
Take-off run 150 m. (164 yds.).
Landing run 85 m. (93 yds.).

PERFORMANCE (135 h.p. Lycoming engine).—
Max. speed 265 km.h. (165 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Ceiling 4,500 m. (14,760 ft.).
Range (4-seater) 700 km. (435 miles).
Take-off run 130 m. (142 yds.).
Landing run 100 m. (109 yds.).



An impression of the Ambrosini P.18 Two-seat *ab initio* Jet Trainer.



The Ambrosini F.7 Rondone (90 h.p. Continental C90 engine).

AVIAMILANO

AVIAMILANO COSTRUZIONI AERONAUTICHE.

HEAD OFFICE : VIA MACEDONIO MELLONI, 70, MILAN.

Managing Director : Ing. Mario Vietri.
Chief Designer : Ing. Stelio Frati.

A new version of the Falco F.8 two-seat cabin monoplane, built by Aviamilano to the design of Stelio Frati, made its first flight on April 25, 1956 and is in series production.

Aviamilano has also built the prototype of a new four-seat cabin monoplane known as the Nibbio F. 14.

THE AVIAMILANO NIBBIO F.14.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. NACA 64000 series (modified) wing section. Aspect ratio 7. Dihedral 5°. All-wood one-piece single-spar structure, covered with plywood. Electrically-operated split flaps between ailerons and fuselage. Total area of ailerons 1.06 m.² (11.41 sq. ft.). Total area of flaps 1.51 m.² (16.25 sq. ft.). Gross wing area 12.90 m.² (138.9 sq. ft.).

FUSELAGE.—All-wood monocoque structure in two sections, bolted together.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Fin and tailplane plywood-covered, rudder and elevators fabric-covered. Controllable trim-tab in elevator. Areas : fin 0.68 m.² (7.32 sq. ft.), rudder 0.58 m.² (6.24 sq. ft.), elevators 1.05 m.² (11.30 sq. ft.), tailplane 1.65 m.² (17.76 sq. ft.). Tailplane span 3.46 m. (11 ft. 4 in.).

LANDING GEAR.—Retractable tricycle type. Electro-mechanical retraction. Doors close when wheels are extended. Air-oil shock-absorbers. Single-disc hydraulic brakes. Steerable nose-wheel.

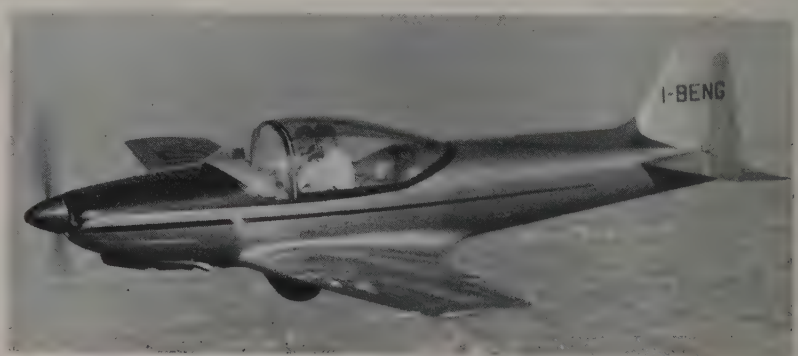
POWER PLANT.—One 180 h.p. Lycoming O-360 four-cylinder horizontally-opposed air-cooled engine, driving two-blade metal constant-speed airscrew. Fuel in two rubber tanks in wings with total capacity of 180 litres (39.6 Imp. gallons).

ACCOMMODATION.—Four seats in enclosed cabin. Two seats side-by-side in front with dual controls. Full-width seat behind. Cabin dimensions 2.10 m. (6 ft. 11 in.) long, 1.08 m. (3 ft. 6½ in.) wide, 1.18 m. (3 ft. 10½ in.) high. Access door on starboard side. Baggage space behind rear seat. Combined heating and ventilation system. Fiberglas soundproofing.

DIMENSIONS.—
Span 9.50 m. (31 ft. 1½ in.).
Length 7.25 m. (23 ft. 9½ in.).
Height 2.46 m. (8 ft. 1 in.).

WEIGHTS AND LOADINGS.—
Weight empty 620 kg. (1,367 lb.).
Weight loaded 1,060 kg. (2,337 lb.).
Wing loading 81.5 kg./m.² (16.7 lb./sq. ft.).
Power loading 5.9 kg./h.p. (13 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 320 km.h. (199 m.p.h.).
Cruising speed at 1,500 m. (5,000 ft.) 290 km.h. (180 m.p.h.).
Stalling speed at S/L. (30° flaps) 87 km.h. (54 m.p.h.).
Service ceiling 5,400 m. (17,700 ft.).
Range, with 30 min. reserve, 1,000 km. (620 miles).



The Aviamilano Falco F.8L Series II (150 h.p. Lycoming O-320 engine).

THE AVIAMILANO FALCO F.8L SERIES II.

The Falco F.8 is a high-performance two-seat lightplane, which flew in its original form on June 15, 1955, and in its present, developed, form on April 25, 1956. It is suitable for use as an *ab initio* trainer, an advanced trainer for instrument flying and aerobatics or as a touring aircraft.

The initial production series of ten aircraft, delivered by Aviamilano in 1956, had 135 h.p. Lycoming engines and are known as Falco F.8L Series I aircraft. The second series of twenty F.8L Series II aircraft, completed during 1957, differ in having a 150 h.p. Lycoming engine, metal airscrew and wing fuel tanks. A third series, now in production, is similar to the second series, to which the following description refers.

TYPE.—Side-by-side Two-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Laminar-flow NACA 64000 series wing section, with 12½% t/c. ratio at root and 10% at tip. Aspect ratio 6.4. All-wood one-piece single-spar structure built integrally with forward portion of fuselage. Plywood-covered. All-wood ailerons and electrically-operated split flaps. Total area of ailerons 0.90 m.² (9.69 sq. ft.). Total area of flaps 1.07 m.² (11.52 sq. ft.). Wing area 10 m.² (107.5 sq. ft.).

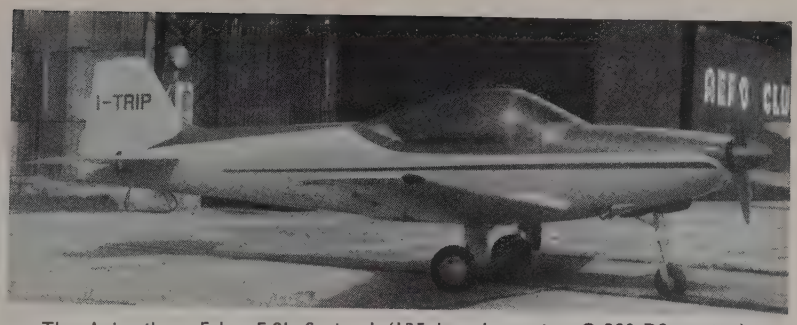
FUSELAGE.—All-wood monocoque structure in two sections, bolted together. Forward section integral with wing. Plywood-covered.

TAIL UNIT.—Cantilever monoplane type. All-wood structure integral with rear portion of fuselage. Tailplane and fin plywood-covered. Rudder and elevators fabric-covered. Controllable trim-tab in elevator. Area of tailplane 2.20 m.² (23.7 sq. ft.). Span of tailplane 3.0 m. (9 ft. 10 in.).

LANDING GEAR.—Retractable tricycle type. Electro-mechanical retraction. Doors close when wheels are extended. Air-oil shock-absorbers. Single-disc hydraulic brakes. Steerable nose-wheel.

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine, driving two-blade fixed-pitch metal airscrew, 1.80 m. (5 ft. 10 in.) diameter. Fuel in two rubber wing tanks with total capacity of 120 litres (26.4 Imp. gallons).

ACCOMMODATION.—Enclosed cabin for two persons. Rearward-sliding transparent canopy. Seats have provision for back-type parachutes. Cabin heating. Baggage locker behind seats.



The Aviamilano Falco F.8L Series I (135 h.p. Lycoming O-290-D2 engine).

DIMENSIONS.—
Span 8.0 m. (26 ft. 3 in.).
Length 6.5 m. (21 ft. 4 in.).
Height 2.27 m. (7 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 515 kg. (1,135 lb.).
Weight loaded 780 kg. (1,720 lb.).
Wing loading 78 kg./m.² (16.0 lb./sq. ft.).
Power loading 5.2 kg./h.p. (11.5 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 345 km.h. (214 m.p.h.).
Cruising speed at 1,500 m. (5,000 ft.) 310 km.h. (193 m.p.h.).
Stalling speed (30° flaps) 85 km.h. (53 m.p.h.).
Rate of climb at S/L. 325 m./min. (1,065 ft./min.).
Service ceiling 5,800 m. (19,000 ft.).
Landing run 130 m. (425 ft.).
Range with 30 min. reserve 1,100 km. (685 miles).

FIAT

SOCIETÀ PER AZIONI FIAT.

HEAD OFFICE: CORSO GIOVANNI AGNELLI, 200, TURIN.

President and Managing Director: Prof. Vittorio Valletta.

Managing Director: Ing. Gaudenzio Bono.

Aviation Division Manager: Ing. Giuseppe Gabrielli.

The branch of the Fiat organisation which is engaged in the production and testing of aircraft and engines is known as:—

FIAT—STABILIMENTI AVIO.

HEAD OFFICE: VIA NIZZA 250, TURIN.

Manager: Ing. Giovanni Perosino.

It includes the following establishments:—

STABILIMENTO VELIVOLI (Aircraft Factory).

WORKS: CORSO FRANCIA 366, TURIN.

STABILIMENTO MOTORI AVIO (Aero-Engine Factory).

WORKS: VIA NIZZA 312, TURIN.

OFFICES: VIA NIZZA 250, TURIN.

OFFICINE DI CASELLE (Caselle Works).

WORKS: TURIN AIRPORT, CASELLE TORINESE.

OFFICINE DEL SANGONE (Sangone Works).

WORKS: STRADA DEL DROSSO, TURIN.

The direction and technical and commercial departments of the central organization co-ordinate the activities of the four above-mentioned establishments, each of which has its own managerial staff.

Fiat has made considerable progress in re-establishing itself since the war in the aircraft field. Over 300 G.46's were built for the Italian and Argentine air forces and a smaller number of G.59's for the Italian Air Force and certain foreign air forces. They were followed by the G.49 advanced trainer, the two prototypes of which were built with different engines.

The G.46, G.49 and G.59 have been described fully in previous editions of "All the World's Aircraft."

Fiat is now engaged in the production of jet-propelled aircraft. Apart from manufacturing de Havilland Vampire 52 and Venom wings under licence, the company has designed and built the G.80 two-seat jet-propelled trainer, of which the developed G.82 version is in production for the Italian Air Force, and is developing the G.91 light ground attack fighter.

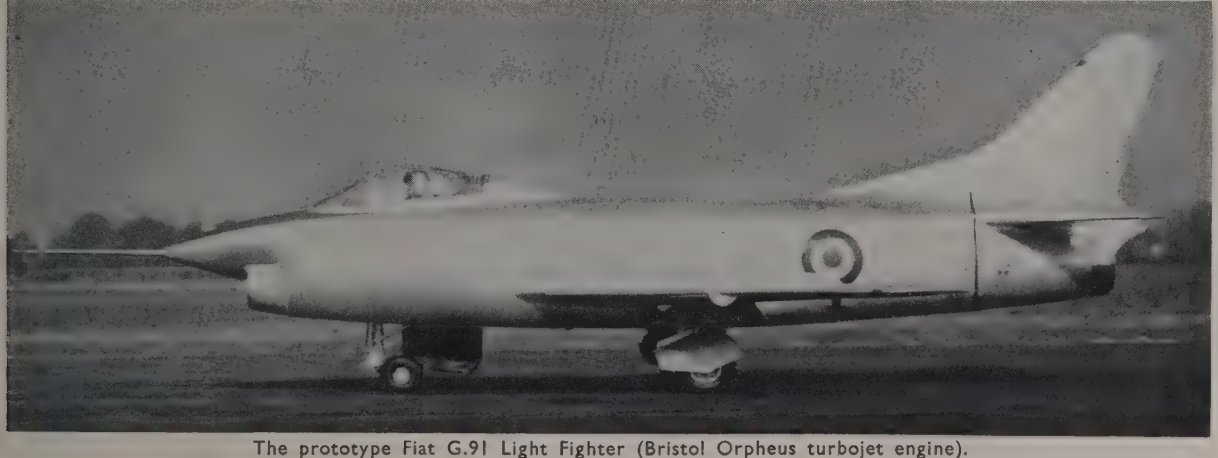
Under an agreement concluded in 1953 between the Italian Government, Fiat and North American Aviation, Inc., Fiat is building the North American F-86K all-weather interceptor fighter. The first Fiat-built F-86K was completed and flown in June, 1955. It was the first of a large number which was ordered with "Off-Shore" procurement funds by the U.S.A.F. for allocation to certain N.A.T.O. air forces. Fiat-built F-86K's have been or will be supplied to the air forces of Italy, Holland, Belgium, France and Western Germany.

A new factory has been built for the overhaul of North American F-86D Sabres, under contract to the U.S. Air Forces in Europe. Fiat is also building mechanical components for the Sikorsky S-58 helicopter under licence, and is developing helicopter projects of its own.

THE FIAT G.91.

The G.91 is a light ground attack fighter, designed in accordance with NATO operational requirements for a light-weight tactical strike fighter which were issued in the Spring of 1954 to the aircraft manufacturers of Western Europe. In the initial evaluation of the eight designs submitted, the Fiat G.91 was one of the two recommended for construction.

Fiat has now been awarded a contract for the construction of three prototypes and twenty-seven pre-production aircraft



The prototype Fiat G.91 Light Fighter (Bristol Orpheus turbojet engine).

and, subject to satisfactory field service trials, the G.91 will be ordered into series production for N.A.T.O. air forces.

Variants are the G.91R for photographic-reconnaissance and the G.91T two-seat transonic trainer with Bristol Orpheus 4 turbojet engine (1,920 kg.= 4,230 lb. s.t.).

The G.91 is an all-metal swept-wing monoplane, powered by a Bristol Orpheus 3 turbojet engine which develops 4,850 lb. (2,200 kg.) s.t..

The first prototype G.91 made its first flight on August 9, 1956, and reached supersonic speed in a dive four times during its 24th test flight early in 1957. It was destroyed a few weeks later during a routine test flight, but its pilot escaped by using the Martin-Baker lightweight ejection seat.

DIMENSIONS (G.91).—
Span 8.55 m. (28 ft. 1 in.).
Length 11.10 m. (36 ft. 5 in.).
WEIGHT (G.91T).—
Weight loaded 4,970 kg. (10,960 lb.).
PERFORMANCE (G.91T).—
Max. speed at S/L 1,000 km.h. (620 m.p.h.).
Max. duration 1 hr. 40 min.



The Fiat G.91 Light Fighter (Bristol Orpheus engine).

THE FIAT G.82.

The G.82 is a development of the Goblin-powered G.80, which has been described in earlier editions of this work.

TYPE.—Two-seat jet Fighter Trainer and Day and Night Flight Trainer.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 4.82. Laminar-flow wing-section. All-metal two-spar structure with swept-back leading-edge and straight trailing-edge. Split flaps inboard of ailerons. Wing area 25.14 m.² (270.6 sq. ft.).

FUSELAGE.—All-metal monocoque structure in three sections. Oval forward section and circular centre and rear sections. All sections are quickly detachable. Aerodynamic brake in underside of centre section.

TAIL UNIT.—Cantilever monoplane type. Tailplane mounted on fin. All-metal structure. Tailplane span 4.25 m. (13 ft. 11 in.).

LANDING GEAR.—Retractable tricycle type. Main wheels raised inwardly, the nose-wheel forward. Hydraulic retraction. Hydraulic wheel brakes. Main wheel track 2.28 m. (7 ft. 6 in.). Wheelbase 4 m. (13 ft. 1 in.).

POWER PLANT.—One Rolls-Royce Nene 6/21 turbojet engine rated at 2,450 kg. (5,400 lb.) s.t. mounted in centre portion of fuselage. Fuel in eight tanks, two in fuselage centre-section, four in wings and two wing-tip tanks. Total fuel capacity 1,755 litres (386 Imp. gallons). Two extra underwing tanks (300 litres = 66 Imp. gallons each) may be fitted.

ACCOMMODATION.—Enclosed cockpits seating two in tandem with dual controls, pupil in front and instructor behind. Martin-Baker seats and jettisonable cockpit covers. Normalair pressurisation. Full electrical equipment, radio, etc.

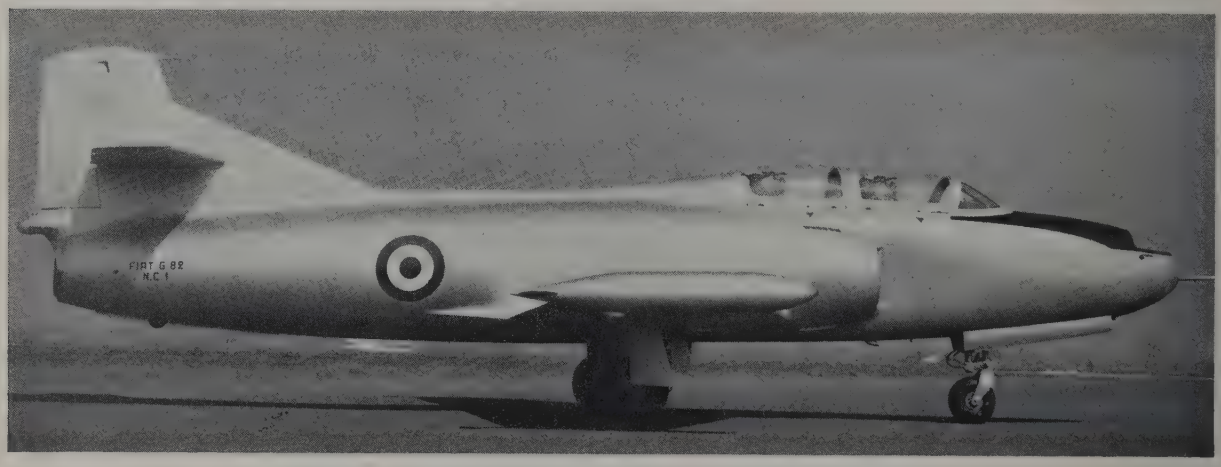
ARMAMENT.—Two Browning-Colt M3 0.5 in. machine-guns with 220 rounds each, or two Hispano-Suiza 804 20 mm. guns with 120 rounds each and empty case and link recovery. Under-wing armament can consist of two bombs (14 kg.-500 lb. or napalm) and eight rockets (5 in.HVAR, 5 in. AR or 2.25 in. practice). Containers of 19 × 2.75 in. or 37 × 2 in. rockets may be substituted for bombs. Containers of 12 × 2.75 in. or 19 × 2 in. rockets may be substituted for the wing-tip fuel tanks.

EQUIPMENT.—K.14 gyro gun-sight or Ferranti Mk. 4 gun-sight. AN-N6 camera-gun.

DIMENSIONS.—
Span 11.808 m. (38 ft. 9½ in.).
Length 12.93 m. (42 ft. 5 in.).
Height 4.075 m. (13 ft. 4½ in.).

WEIGHTS AND LOADING.—
Weight empty 4,400 kg. (9,700 lb.).
Weight loaded 6,250 kg. (13,780 lb.).
Max. permissible weight 7,000 kg. (15,430 lb.).
Wing loading 248.6 kg./m.² (50.96 lb./sq. ft.).

PERFORMANCE.—
Max. speed at 3,000 m. (9,840 ft.) 925 km.h. (575 m.p.h.).
Min. speed with flaps 185 km.h. (115 m.p.h.).
Climb to 6,000 m. (19,680 ft.) 4 min. 30 sec.
Climb to 9,000 m. (29,520 ft.) 8 min. 15 sec.
Service ceiling 13,000 m. (42,600 ft.).
Max. range 1,600 km. (1,000 miles).
Max. endurance 165 min.
Take-off run with flaps 600 m. (656 yds.).



The Fiat G.82 Fighter Trainer (Rolls-Royce Nene turbojet engine).

MACCHI

AERONAUTICA MACCHI S.A.

HEAD OFFICE: CORSO VITTORIO EMANUELE 31, MILAN.

OFFICES AND WORKS: VIA SANVITO SILVESTRO 80, VARESE.

President: Dott. Ing. Paolo Foresio.

Technical Director and Chief Engineer: Ing. Ermanno Bazzocchi.

The Macchi company was founded in 1912 in Varese and its first aeroplane was built in 1913.

Between the wars it established for itself a world-wide reputation as the designer and builder of a series of racing seaplanes. The Macchi 7 flying-boat won the 1921 Schneider Trophy contest, the Macchi 39 the 1926 contest and the Macchi 52*bis* was second in the 1929 contest.

In October, 1933, a Macchi-Castoldi 72 established a World's Speed Record at 709.2 km.h. (440.67 m.p.h.), and this still stands to the credit of Italy as a seaplane record.

Since the end of the war the Macchi company has developed the M.B. 308 two-seat light cabin monoplane, the M.B. 320, a twin-engined six-seat monoplane, and the M.B. 323 trainer. The M.B. 308 has been supplied to both the Italian Air Force and to the civil air authorities. A description of all three aircraft has appeared in previous editions of "All the World's Aircraft."

Macchi is building the Fokker S.11 under licence for the Italian Government under the designation M.416 and has a contract for the overhaul and repair of Lockheed T-33 trainers used by the Italian Air Force.

The first of two prototypes of the Macchi M.B. 326 jet-trainer was scheduled to fly in the autumn of 1957.

THE MACCHI M.B. 326.

TYPE.—Two-seat Jet-trainer.

WINGS.—Mid-wing cantilever monoplane. Wing section NACA 6A. Aspect ratio 5.26. Mean chord 1.9 m. (6.23 ft.). Dihedral

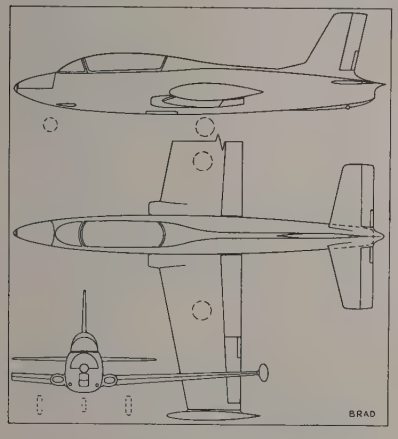
2° 55′. Incidence 2½°. All-metal single-spar stressed-skin structure in three sections, of which the centre-section is integral with the fuselage. Servo-tab operated all-metal ailerons and Fowler flaps. Total area of ailerons 1.32 m.² (14.208 sq. ft.). Total area of flaps 2.62 m.² (28.2 sq. ft.). Gross wing area 19 m.² (204.5 sq. ft.).

FUSELAGE. — All-metal semi-monocoque structure. Dive-brake under centre fuselage, hydraulically operated.

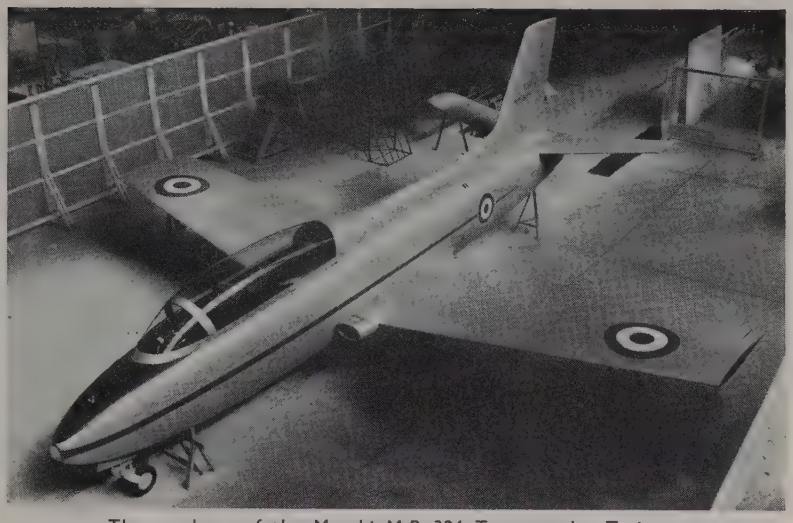
TAIL UNIT.—All-metal cantilever monoplane structure. Areas: fin 1.69 m.² (18.19 sq. ft.), rudder 0.75 m.² (8.07 sq. ft.), tailplane 2.69 m.² (28.96 sq. ft.), elevators 1.07 m.² (11.52 sq. ft.). Tailplane span 4.08 m. (13 ft. 4½ in.).

LANDING GEAR. — Hydraulically-retracted nosewheel type, with oleo-pneumatic shock-absorber struts. Hydraulic brakes. Steerable nose-wheel. Wheel-base 4.17 m. (13.68 ft.). Wheel track 2.37 m. (7.78 ft.).

POWER PLANT.—One Armstrong Siddeley Viper ASV.8 axial-flow turbojet engine (1,750 lb.=790 kg. s.t.). Capacity of fuselage fuel tank 860 litres (190 Imp. gallons). Two droppable 150 litre (33 Imp. gallons) wing-tip tanks may also be fitted.



The Macchi M.B. 326.



The mock-up of the Macchi M.B. 326 Two-seat Jet Trainer.

ACCOMMODATION.—Crew of two in tandem under a one-piece moulded Perspex sideways-hingeing canopy. Pressurised cabin. Dual controls and instruments. Blind flying screens for pupil. Martin-Baker ejection seats. Equipment includes VHF radio and radio-compass.

ARMAMENT.—Two 7.7 mm. machine-guns in fuselage, gun-camera. Four 6 kg. (13.2 lb.) or 7.5 kg. (16.7 lb.) rockets and four 15 kg. (33 lb.) or 45 kg. (100 lb.) bombs under wings.

DIMENSIONS.—
Span 10.04 m. (32 ft. 11 in.).
Length 10.50 m. (34 ft. 5 in.).
Height 3.46 m. (11 ft. 4 in.).

WEIGHTS.—
Weight empty 1,950 kg. (4,299 lb.).
Crew (2) 170 kg. (375 lb.).
Fuel 685 kg. (1,510 lb.).
Radio equipment 45 kg. (99 lb.).
Weight loaded 2,850 kg. (6,283 lb.).
Wing loading 144.7 kg./m.² (30.72 lb./sq. ft.).
Power loading 3.59 kg./kg. s.t. (3.59 lb./lb. s.t.).

PERFORMANCE (Estimated).—
Max. speed at 9,000 m. (29,500 ft.) 725 km.h. (450.5 m.p.h.).
Cruising speed at 6,000 m. (19,700 ft.) 470 km.h. (292 m.p.h.).
Min. speed (flaps retracted) 145 km.h. (90 m.p.h.).
Min. speed (flaps down) 139 km.h. (80 m.p.h.).
Rate of climb at S/L. 930 m./min. (3,050 ft./min.).
Climb to 3,000 m. (9,800 ft.) 4 min.
Climb to 6,000 m. (19,700 ft.) 9 min.
Climb to 9,000 m. (29,500 ft.) 18 min.
Service ceiling 11,000 m. (36,080 ft.).
Range at 9,000 m. (29,500 ft.) 1,330 km. (826 miles).
Take-off run 500 m. (1,640 ft.).
Landing-run, with brakes 280 m. (920 ft.).

METEOR

METEOR S.p.A. COSTRUZIONI AERONAUTICHE.

HEAD OFFICE: 2 VIA MILANO, TRIESTE.
ROME OFFICE: 29 VIA DALMAZIA.
WORKS: RONCHI DEI LEGIONARI, MONFALCONE.

Chairman and Managing Director: Avv. Furio Lauri.

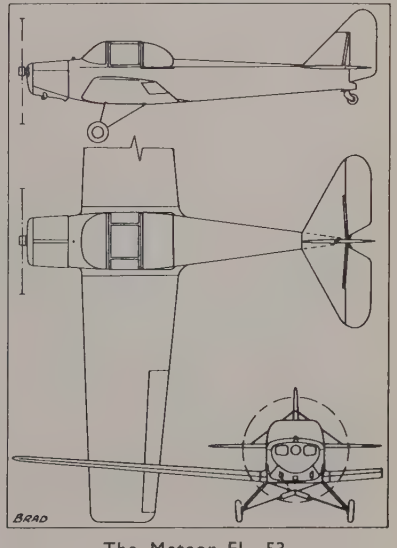
Meteor S.p.A. was formed in 1947 to undertake the manufacture of aircraft, the operation of feeder-line air services and the management and operation of airports.

In the field of aircraft construction, the company has continued the activities of the aeronautical department of the Cantieri Riuniti dell'Adriatico, Monfalcone, which, before the last war built CANT-Zappata aircraft.

Originally Meteor undertook the construction of gliders and sailplanes of various types, including the Meteor MS.18, MS.21, MS.30 and, under licence, the Canguru type sailplanes. The company continues to supply all accessories and equipment for glider flying, notably the Meteor Dolomiti glider-winch with automatic hydraulic gears and double cable drum.

In 1953 Meteor took over the aeronautical designs and equipment of Francis Lombardi & C. (formerly Azionari Vercellese Industrie Aeronautiche—AVIA) of Vercelli, whose products included the AVIA (Lombardi) FL.3 of which more than 500 were built between 1939 and 1948.

All current Meteor aircraft are developed from the AVIA FL.3. They include the FL.53 two-seat aerobatic monoplane for touring and training, and the three-seat FL.54 and four-seat FL.55 general-purpose monoplanes with differing powerplants, which may be used for many purposes, including glider-towing, agricultural dusting and spraying, etc. A new version of the FL.55, developed in 1956 and designated FL.55B, has a combination wheel/ski landing gear for use in mountainous regions. Details of these aircraft follow.



The Meteor FL. 53.



The Meteor FL. 53 (60 h.p. C.N.A. D.4 engine).

THE METEOR FL. 53.

TYPE.—Two-seat Trainer and Tourer.

WINGS.—Low-wing cantilever monoplane. All-wood structure. Differential ailerons. Flaps not normally fitted, but can be on request. Wing area 13.9 m.² (150 sq. ft.).

FUSELAGE.—Of mixed steel-tube and wood construction with fabric covering.

TAIL UNIT.—Braced monoplane type. Steel-tube framework covered with fabric.

LANDING GEAR.—Fixed tail-wheel type. Rubber-in-compression springing. Hydraulic brakes on main wheels. Steerable tail-wheel.

POWER PLANT.—One 60 h.p. C.N.A. D.4 or 65 h.p. Continental A65 four-cylinder air-cooled engine. Fuel tank (17 U.S. gallons = 60 litres) in fuselage. Provision for external auxiliary tank of similar capacity below fuselage. Filler cap of latter tank accessible through hole in underside of fuselage to permit contents to be transferred to main tank by hand-pump.

ACCOMMODATION.—Two seats side-by-side with dual controls beneath sliding Plexiglas canopy. Roof and rear section of canopy tinted for glare protection. Seat backs are adjustable so that they can be used with or without parachutes. Canopy has spring release for emergency exit.

DIMENSIONS.—
Span 9.85 m. (32 ft. 3½ in.).
Length 6.37 m. (20 ft. 10½ in.).
Height 1.80 m. (5 ft. 10½ in.).

WEIGHTS.—
Weight empty 360 kg. (794 lb.).
Disposable load (normal) 220 kg. (484 lb.).
Disposable load (aerobatic) 190 kg. (419 lb.).
Weight loaded (normal) 570 kg. (1,254 lb.).
Weight loaded (aerobatic) 525 kg. (1,155 lb.).

PERFORMANCE (560 kg. A.U.W.—65 h.p. Continental engine).
Max. speed 165 km.h. (103 m.p.h.).
Cruising speed 143 km.h. (88 m.p.h.).
Initial rate of climb 120 m./min. (395 ft./min.).
Service ceiling 3,700 m. (12,140 ft.).
Stalling speed 40 km.h. (25 m.p.h.).
Take-off run (no wind) 170 m. (560 ft.).
Landing run (without brakes) 120 m. (395 ft.).
Endurance 3 hours normal, 6 hrs. with auxiliary tank.

THE METEOR FL.54.

The FL.54 is a three-seat higher-powered version of the FL.53. It can be fitted with either the 85 h.p. or 90 h.p. Continental engine. The third seat is placed centrally in the rear of the cabin.

The FL.54 is a general purpose aircraft which can be used for touring, training, glider-towing, etc.

DIMENSIONS.—
Same as for FL.53.

WEIGHTS (90 h.p. Continental C90 and metal propeller).—
Weight empty 380 kg. (838 lb.).
Normal disposable load 272 kg. (600 lb.).
Normal loaded weight 700 kg. (1,543 lb.).

PERFORMANCE (695 kg. A.U.W., 90 h.p. Continental C90 engine).—
Max. speed 196 km.h. (122 m.p.h.).



The Meteor FL.54 Seaplane (90 h.p. Continental C90 engine).

Cruising speed 181 km.h. (113 m.p.h.).
Initial rate of climb 60 m./min. (200 ft./min.).
Service ceiling 2,500 m. (8,200 ft.).
Absolute ceiling 4,500 m. (14,760 ft.).
Stalling speed 67 km.h. (41.5 m.p.h.).
Take-off run (no wind) 300 m. (985 ft.).
Landing run (with brakes) 170 m. (560 ft.).
Endurance 2.3 hrs. normal, 5 hrs. with auxiliary tank.

THE METEOR FL.55.

The FL.55 is similar to the FL.54 but is a four-seater with a reinforced airframe and is fitted with a 130 h.p. or 150 h.p. Lycoming engine.

In addition to touring and training, the FL.55 can be adapted for agricultural work (spraying and dusting), high-altitude glider towing, etc. It can also be fitted with floats or skis.

The standard 4-seat version is fitted with dual controls, flaps, electric starter, VHF radio and standard instrument panel.

The spraying and dusting equipment, which can be installed or removed in 15 minutes, consists of a spray or dust tank with a normal capacity for 300 kg. (661 lb.), wind-driven centrifugal pump, gauges, controls and spray booms and 48 nozzles or a Venturi-type dust distributor. The tank is fitted in place of the third seat. During spraying or dusting operations the Plexiglas canopy is removed completely to facilitate refilling.

DIMENSIONS.—
Same as for FL.53.

WEIGHTS (Standard 150 h.p. 4-seat version).—
Weight empty 450 kg. (992 lb.).
Pilot and 3 passengers 300 kg. (666 lb.).
Fuel and oil 50 kg. (110 lb.).
Baggage 27 kg. (60 lb.).
Weight loaded 800 kg. (1,776 lb.).

WEIGHTS (150 h.p. Agricultural version).—
Weight empty 493 kg. (1,085 lb.).
Pilot 73 kg. (162 lb.).
Spraying liquid or dust 300 kg. (661 lb.).
Fuel and oil 50 kg. (110 lb.).
Weight loaded 900 kg. (1,984 lb.).

PERFORMANCE (Standard 150 h.p. 4-seat version).
Max. speed 214 km.h. (133 m.p.h.).
Cruising speed 190 km.h. (118 m.p.h.).
Initial rate of climb 120 m./min. (395 ft./min.).
Service ceiling 3,500 m. (11,500 ft.).
Take-off run (no wind) 230 m. (755 ft.).
Landing run (with flaps and brakes) 180 m. (590 ft.).
Endurance 2 hrs. normal, 4 hrs. with auxiliary tank.

PERFORMANCE (150 h.p. Agricultural version).—
Operational speed 90-120 km.h. (56-75 m.p.h.).
Stalling speed at gross weight 80 km.h. (50 m.p.h.).
Take-off run at gross weight (no wind) 220 m. (720 ft.).
Endurance 2 hours.

THE METEOR FL.55B.

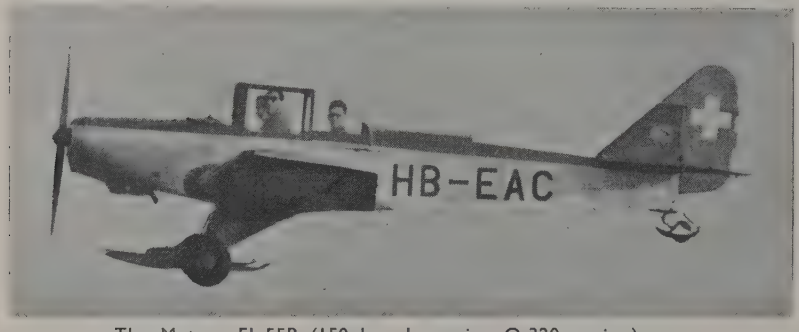
Basically similar to the FL.55, the FL.55B differs in that it is fitted with a combination wheel-ski landing gear for operation in mountainous regions. When not in use, the metal skis are retracted hydraulically from the cockpit to a position just below the wheel axles.

After comparative trials of the prototype FL.55B against another lightplane, it was chosen in 1956 to equip a Swiss mountain rescue organisation. It is powered by a 150 h.p. Lycoming engine and carries a pilot and either three passengers or a stretcher.

DIMENSIONS.—
Same as for FL.53.

WEIGHTS.—
Same as for FL.55.

PERFORMANCE (800 kg. A.U.W.).—
Max. speed 205 km.h. (127 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Stalling speed 80 km.h. (50 m.p.h.).
Climb to 1,000 m. (3,050 ft.) 4 min. 10 sec.
Service ceiling 6,000 m. (19,700 ft.).
Take-off distance 120 m. (395 ft.).
Landing distance (with flaps and brakes) 130 m. (425 ft.).



The Meteor FL.55B (150 h.p. Lycoming O-320 engine).

NARDI

NARDI S.A. PER COSTRUZIONI AERONAUTICHE.

HEAD OFFICE AND WORKS: AEROPORTO FORLANINI, MILAN.

President: Dr. Ing. Luigi Nardi.

Vice-President: Dr. Elto Nardi.

This concern was established by the four Nardi brothers in Milan in 1933. Their first product, the F.N. 305, first flew in 1935.

The Nardi factory at Loreto was almost completely destroyed during the war, but the Milan factory has been rebuilt and the prototype of the company's first post-war aircraft, the FN-333 all-metal amphibian, flew for the first time on December 4, 1952. The first prototype was a three-seater and was powered by a 145 h.p. Continental engine. From this has been developed the four-seat production model of slightly larger dimensions and powered by a 240 h.p. Continental engine. A prototype of this version first flew on December 8, 1954, and an experimental model built to production standards for airworthiness approval made its first flight on October 14, 1956. Production aircraft will be manufactured by Fiat at Turin, and deliveries are scheduled to begin by the Spring of 1958.

In addition to aircraft manufacture, the company has specialised in the production of wheels, brakes, retractable landing gears, hydraulic and electric aircraft controls, fuel pumps, armament installations and aircraft accessories generally.

THE NARDI FN-333.

TYPE.—Four-seat boat Amphibian.

WINGS.—High-wing cantilever monoplane. NACA 23000 Series wing section. Aspect ratio 6.5. Mean chord 1.51 m. (4.95 ft.). Dihedral 2°. Incidence 3°. Two-spar all-metal stressed-skin construction. Centre-section, attached to hull, carries tail-booms and engine mounting. All-metal slotted ailerons. All-metal split flaps inboard of ailerons. Total area of ailerons .97 m.² (10.4 sq. ft.). Total area of flaps 1.92 m.² (20.7 sq. ft.). Gross wing area 15.14 m.² (163 sq. ft.).

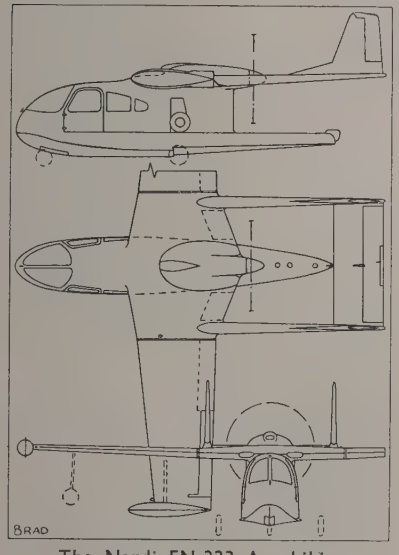
HULL.—Single-step all-metal stressed-skin structure. Hull below cabin floor has series of watertight compartments. Deck

of rear portion provided with manholes and drain openings. Rudder hinged to sternpost.

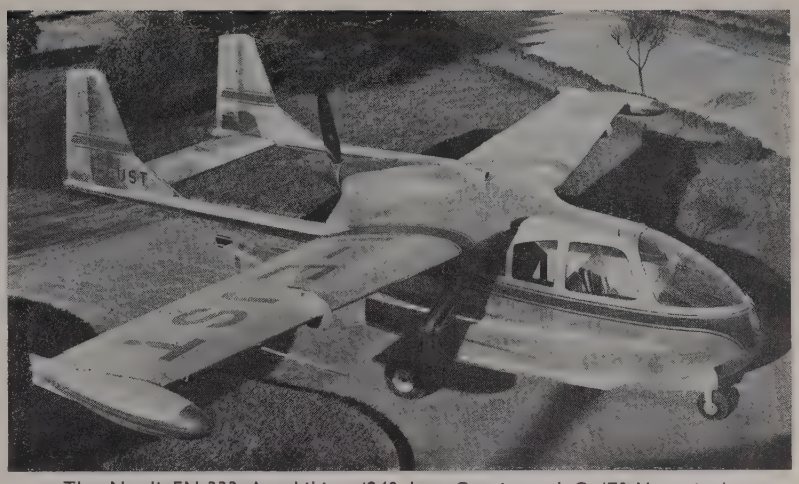
TAIL BOOMS.—Each is a tapered tube made from a single duralumin sheet. Bolted to wing centre-section through flanged duralumin collars.

TAIL UNIT.—Rectangular tailplane between ends of booms. Fins riveted to booms. Statically and aerodynamically balanced elevator has central controllable trim-tab. Aerodynamically-balanced rudders. Entire tail unit is of metal stressed-skin construction. Areas: fins 2.28 m.² (24.6 sq. ft.), rudders 0.76 m.² (8.2 sq. ft.), elevators 1.0 m.² (10.7 sq. ft.), tailplane 1.49 m.² (16 sq. ft.). Tailplane span (centre-line of booms) 2.50 m. (8 ft. 2 in.).

LANDING GEAR. — Retractable nose-wheel type. Two main units are independent but are retracted by a single hydraulic jack. When retracted each unit is entirely buried in side of hull. Nardi hydraulic shock-struts. Wheels are of peralumin anti-corrosive alloy and have Nardi hydraulic disc brakes. Main wheel track 1.88 m. (6 ft. 2 in.). Wheelbase 2.80 m. (9 ft. 2 in.).



The Nardi FN-333 Amphibian.



The Nardi FN-333 Amphibian (240 h.p. Continental O-470-H engine).

WING TIP FLOATS.—Retractable floats are of peralumin non-corrosive alloy and are carried on single struts. Hydraulic retraction. When raised are located at wing-tips.

POWER PLANT.—One 240 h.p. Continental O-470-H six-cylinder horizontally-opposed fan-cooled engine buried in centre-section. Hartzell constant-speed feathering pusher airscrew with armoured wood blades. Electric starter. Two fuel tanks in wings. Total fuel capacity 300 litres (66 Imp. gallons). Oil capacity 16 litres (3.5 Imp. gallons).

ACCOMMODATION.—Cabin seats four, two side-by-side in front with dual controls and two on a bench-type seat behind. Soundproofed, air-conditioned and heated cabin. Large door on each side and backs of front seats hinge forward to give access to rear seat. Radio. Electric position indicators for landing-gear, flaps and wing-tip floats. Baggage capacity 0.42 m.³ (15 cub. ft.).

DIMENSIONS.—
Span 10.36 m. (34 ft. 0 in.).
Length overall 7.30 m. (23 ft. 11 in.).
Height overall 3.23 m. (10 ft. 7 in.).

WEIGHTS AND LOADINGS.—
Weight empty 890 kg. (1,962 lb.).
Normal disposable load 460 kg. (1,014 lb.).
Max permissible disposable load: 513 kg. (1,130 lb.).
Normal loaded weight 1,350 kg. (2,976 lb.).
Max. permissible loaded weight 1,403 kg. (3,092 lb.).
Max. wing loading 87.9 kg./m.² (18 lb./sq. ft.).
Max. power loading 5.85 kg./h.p. (12.9 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 290 km.h. (180 m.p.h.).
Cruising speed at 2,450 m. (8,000 ft.) 265 km.h. (165 m.p.h.).
Stalling speed with flaps 105 km.h. (65 m.p.h.).
Rate of climb at S/L. 390 m./min. (1,280 ft./min.).
Service ceiling 6,100 m. (20,000 ft.).
Normal range 900 km. (560 miles).
Max. range 1,245 km. (775 miles).
Take-off run on ground 275 m. (900 ft.).
Take-off run on water 420 m. (1,380 ft.).
Landing run on ground 200 m. (660 ft.).

PARTENAVIA

PARTENAVIA COSTRUZIONI AERONAUTICHE.

HEAD OFFICE: VIA TASSO 480, NAPLES.

This company has built a series of light aircraft to the designs of Luigi Pascale, including the P-48-B Astore two-seat high-wing monoplane, which first flew in 1952, the P-52 Tigrotto three-seat low-wing monoplane of 1953 and the later P-53 Aeroscooter and P-55 Tornado.

A completely new four-seat touring aircraft, the P-57 Fachiro, is under development and was scheduled to make its first flight during 1957.

THE PARTENAVIA P-57 FACHIRO.

The Fachiro has been designed as a simple, inexpensive high-wing monoplane that can be powered by any engine in the 90-150 h.p. class. There will be three basic versions :—

P-57-1. Four-seat touring and general purpose aircraft.

P-57-2. Side-by-side two-seat version with additional fuel tankage for long-range operation.

P-57-3. Tandem two-seat version for military observation and liaison duties.

Construction can be either all-metal or composite wood and metal. Aircraft of composite construction will be designated P-57-1M, P-57-2M and P-57-3M.

The prototype P-57-1M was due to fly during 1957 and the following details refer specifically to this version.

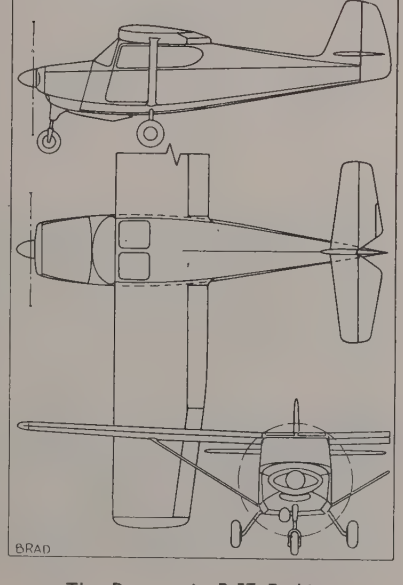
TYPE.—Four-seat Touring monoplane.

WINGS.—High-wing braced monoplane. Aspect ratio 6.26. Mean chord 1.47 m. (4 ft. 10 in.). Single-spar all-wood structure with a single bracing strut on each side. Total area of ailerons 1.29 m.² (13.88 sq. ft.). Total area of flaps 1.45 m.² (15.50 sq. ft.). Gross wing area 13.5 m.² (145.3 sq. ft.).

FUSELAGE.—Welded steel-tube structure, with fabric covering.

TAIL UNIT.—Cantilever monoplane type. Wooden construction. Areas: fin 0.375 m.² (4.04 sq. ft.), rudder 0.73 m.² (7.86 sq. ft.), tailplane 1.20 m.² (12.92 sq. ft.), elevators (total) 1.125 m.² (12.11 sq. ft.).

LANDING GEAR.—Non-retractable nosewheel type with cantilever legs. Oleo shock-absorbers on all units. Steerable nose-wheel. Elektron wheels with Pirelli 7.00× 6 tyres on main wheels. Hydraulic brakes.



The Partenavia P-57 Fachiro.

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine driving a two-blade Aeromatic fixed or controllable-pitch airscrew.

ACCOMMODATION.—Cabin seats four in two pairs, front pair with dual controls.

DIMENSIONS.—
Span 9.2 m. (30 ft. 2 in.).
Length 6.16 m. (20 ft. 3 in.).
Height 1.93 m. (6 ft. 4 in.).

WEIGHTS AND LOADINGS.—
Weight empty 489 kg. (1,078 lb.).
Weight loaded 903 kg. (1,991 lb.).
Wing loading 66.8 kg./m.² (13.68 lb./sq. ft.).
Power loading 6.02 kg./h.p. (13.27 lb./h.p.).

PERFORMANCE (estimated).—
Max. speed 232 km.h. (144 m.p.h.).
Cruising speed 195 km.h. (121 m.p.h.).
Minimum speed 73 km.h. (45.5 m.p.h.).
Service ceiling 4,000 m. (13,125 ft.).
Climb to 1,000 m. (3,280 ft.) 5 min.

THE PARTENAVIA P-53 AEROSCOOTER.

This ultra-light monoplane is unique, because it is so designed that a two-blade rotor can be mounted on the top of the crash pylon over the cabin, to auto-rotate in forward flight and reduce considerably both the stalling speed and rate of descent with engine off.

It was designed by Luigi Pascale to the specifications of Mario de Bernardi, who won for Italy the 1926 contest for the Schneider Trophy. The prototype made its initial flights with a 22 h.p. Ambrosini P-25 engine and without the rotor. A 38 h.p. C.N.A.-C2 engine is specified for any subsequent production Aeroscooters.

TYPE.—Single-seat Ultra-light monoplane.

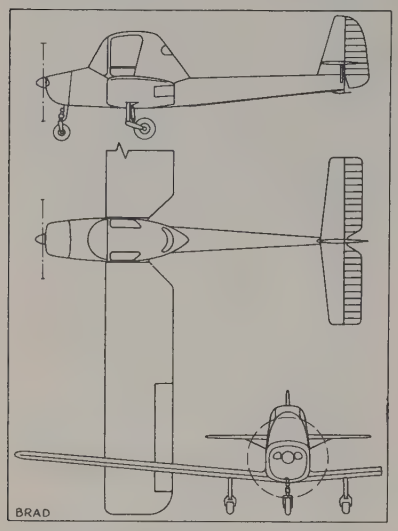
WINGS.—Low-wing cantilever monoplane. All-wood single-spar structure. N.A.C.A. 63-series section. Aspect ratio 8.24. Chord 0.98 m. (3 ft. 3 in.). Total area of ailerons 1.10 m. (11.84 sq. ft.). No flaps. Wing area 8.3 m.² (89.34 sq. ft.).

FUSELAGE.—All-metal structure, with circular-section monocoque tail boom.

TAIL UNIT.—Braced monoplane type, with tailplane mounted part-way up the fin. All-metal structure, with fabric-covered fin and tailplane and metal-covered rudder and elevators. Areas: fin 0.29 m.² (3.12 sq. ft.), rudder 0.33 m.² (3.55 sq. ft.), tailplane 0.77 m.² (8.28 sq. ft.), elevators 0.67 m.² (7.21 sq. ft.).

LANDING GEAR.—Fixed tricycle type. Steerable nose-wheel. Manual brakes.

POWER PLANT.—One 38 h.p. C.N.A.-C2 two-cylinder horizontally-opposed air-cooled engine, driving a two-blade fixed-pitch wooden airscrew.



The Partenavia P-53 Aeroscooter.



The Partenavia P-53 Aeroscooter (38 h.p. C.N.A. C2 engine).

ACCOMMODATION.—Enclosed cabin, entered by large door on starboard side. Crash pylon above cockpit forms mounting for two-blade auto-rotating rotor.

DIMENSIONS.—
Span 8.28 m. (27 ft. 2 in.).
Length 5.12 m. (16 ft. 10 in.).
Height 1.70 m. (5 ft. 7 in.).

WEIGHTS AND LOADINGS.—
Weight empty 180 kg. (397 lb.).
Weight loaded 280 kg. (617 lb.).
Wing loading 33.7 kg./m.² (6.9 lb./sq. ft.).
Power loading 7.4 kg./h.p. (16.31 lb./h.p.).

PERFORMANCE (without rotor).—
Max. speed at S/L. 150 km.h. (93 m.p.h.).
Cruising speed 120 km.h. (75 m.p.h.).
Min. speed 60 km.h. (37.3 m.p.h.).
Ceiling 3,500 m. (11,500 ft.).
Range 550 km. (342 miles).

THE PARTENAVIA P-55 TORNADO.

Designed as a high-performance two-seat competition and touring aircraft, the Tornado has twice won the Giro di Sicilia contest. Despite its small size, it has a fully-retractable landing gear and can achieve 347 km.h. (216 m.p.h.) with full load on a 150 h.p. Lycoming engine.

TYPE.—Two-seat Cabin monoplane.

WINGS.—Mid-wing cantilever monoplane. N.A.C.A. 6-series laminar-flow section. Aspect ratio 6.5. Chord at root 1.48 m. (4 ft. 9 in.), at tip 0.63 m. (2 ft. 1 in.). All-wood single-spar structure, plywood covered. Manually-operated flaps. Total area of ailerons 0.50 m.² (5.38 sq. ft.). Total area of flaps 0.92 m.² (9.90 sq. ft.). Wing area 8 m.² (86.1 sq. ft.).

FUSELAGE.—All-wood monocoque structure, plywood-covered.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Areas: fin 0.42 m.² (4.52 sq. ft.), rudder 0.21 m.² (2.26 sq. ft.), tailplane 0.78 m.² (8.40 sq. ft.)., elevators 0.50 m.² (5.38 sq. ft.).

LANDING GEAR.—Retractable tricycle type. Oleo-pneumatic shock-absorbers. Manual hydraulic retraction. Hydraulic brakes. Tyres Pirelli 400 × 100 (main wheels), 300 × 100 (nose-wheel).

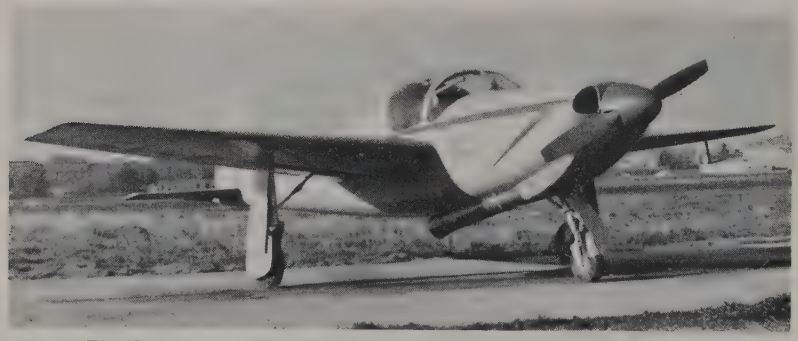
POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine, driving two-blade fixed-pitch airscrew. Fuel capacity 120 litres (26.4 Imp. gallons).

ACCOMMODATION.—Enclosed cabin with side-by-side seating for two persons. Dual controls.

DIMENSIONS.—
Span 7.20 m. (23 ft. 7½ in.).
Length 6.0 m. (19 ft. 9 in.).
Height 1.80 m. (5 ft. 10½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 480 kg. (1,058 lb.).
Weight loaded 710 kg. (1,565 lb.).
Wing loading 88.8 kg./m.² (18.19 lb./sq. ft.).
Power loading 4.73 kg./h.p. (10.42 lb./h.p.).

PERFORMANCE.—
Max. speed 347 km.h. (216 m.p.h.).
Cruising speed 303 km.h. (188 m.p.h.).
Stalling speed 95 km.h. (59 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min.
Ceiling 6,000 m. (19,685 ft.).
Range 950 km. (590 miles).



The Partenavia P-55 Tornado (150 h.p. Lycoming O-320 engine).

PASOTTI

LEGNAMI PASOTTI S.p.A.

HEAD OFFICE AND WORKS: VIA MASSIMO D'AZEGLIO 6, BRESCIA.

Director: Dott. Ing. Piero Pasotti.

World Concessionaire: Vico Rosaspina, Via Rossini 1, Milan.

This company has built the F.6 and F.9 four-seat cabin monoplanes which were designed to serve as four-seat touring aeroplanes and also to be suitable for use as executive transports or as ambulances.

THE PASOTTI F.6 AIRONE.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 7.6. Mean chord 1.43 m. (4 ft. 8 in.). Single-piece single-spar wing of all wood construction with stressed plywood skin. Differential ailerons. Trailing-edge flaps. Area of ailerons 1.51 m.² (16.25 sq. ft.) Flap area 2.10 m.² (22.6 sq. ft.). Gross wing area 14.7 m.² (158 sq. ft.).

FUSELAGE.—All-wood stressed-skin monocoque structure in two sections bolted together aft of trailing-edge of wing.

TAIL UNIT.—Cantilever monoplane type. Of similar structure to wings. Fixed surfaces covered with plywood, movable surfaces with fabric. Areas: fin 0.73 m.² (7.85 sq. ft.), rudder 0.69 m.² (7.42 sq. ft.), tailplane 1.02 m.² (10.9 sq. ft.), elevators 1.68 m.² (18.07 sq. ft.). Span of tail 3.31 m. (10 ft. 10 in.).

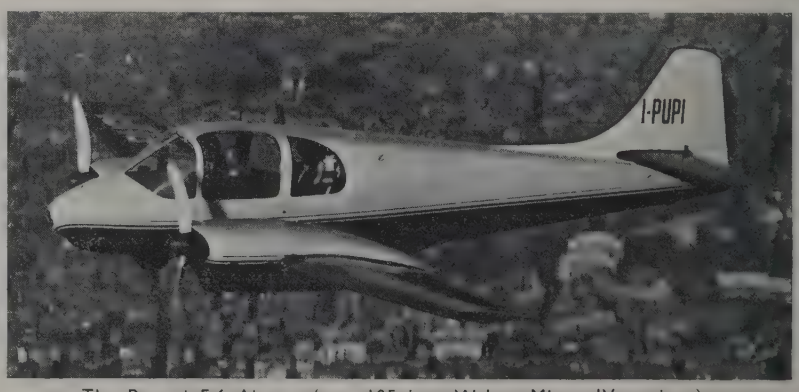
LANDING GEAR.—Retractable nose-wheel type. Main landing gear struts of knee-action type with oleo-pneumatic springing. Long-stroke nose-wheel shock-absorber strut with hydraulic anti-shimmy device. Hydraulic wheel-brakes.

POWER PLANT.—Two 105 h.p. Walter Minor IV four-cylinder inverted in-line air-cooled engines. Other engines of from 90 h.p. to 140 h.p. can be installed. Fixed or controllable-pitch airscrews may be fitted. In production aircraft all fuel in two wing-tip tanks, each of 130 litres (30 Imp. gallons) capacity.

ACCOMMODATION.—Enclosed cabin seating four in two pairs, front pair with dual controls. Wide metal door on each side. Baggage compartment behind cabin with outside access. Cabin is sound-proofed and air-conditioned. Radio and night-flying equipment.

DIMENSIONS.—
Span 10.54 m. (34 ft. 7 in.).
Length 7.25 m. (23 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 850 kg. (1,874 lb.).
Weight loaded 1,400 kg. (3,087 lb.).



The Pasotti F.6 Airone (two 105 h.p. Walter Minor IV engines).

Wing loading 95.0 kg./m.² (19.45 lb./sq. ft.).
Power loading 6.65 kg./h.p. (14.66 lb./h.p.).

PERFORMANCE (105 h.p. Walter).—
Max. speed 300 km.h. (186 m.p.h.).
Normal cruising 260 km.h. (162 m.p.h.).
Stalling speed 90 km.h. (56 m.p.h.).
Ceiling 5,500 m. (18,050 ft.).
Ceiling (single engine) 1,800 m. (5,900 ft.).
Max. range 1,200 km. (745 miles).
Take-off run 200 m. (655 ft.).
Landing run 150 m. (164 yds.).

THE PASOTTI F.9 SPARVIERO.

The F.9 is a single-engined version of the F.6. The prototype, which at the time of writing was undergoing its airworthiness trials, is fitted with a 250 Hirth eight-cylinder inverted Vee air-cooled engine; but production aircraft will have the 260 h.p. Lycoming engine.

The wings, tail-unit, landing-gear, and accommodation of the F.9 are identical to those of the F.6 previously described.

POWER PLANT.—One 250 h.p. Hirth HM.508 eight-cylinder inverted 60° vee air-cooled engine. Two-blade electric controllable-pitch airscrew. Three fuel tanks, two in wings and one in fuselage. Total fuel capacity 240 litres (53 Imp. gallons).

DIMENSIONS.—
Span 10.0 m. (32 ft. 9½ in.).
Length 8.3 m. (27 ft. 2½ in.).

WEIGHTS.—
Weight empty 990 kg. (2,178 lb.).
Weight loaded 1,520 kg. (3,344 lb.).

PERFORMANCE.—
Max. speed 320 km.h. (196 m.p.h.).
Normal cruising speed 264 km.h. (165 m.p.h.).
Stalling speed 85 km.h. (53 m.p.h.).
Service ceiling 5,030 m. (16,500 ft.).
Max. range 1,310 km. (860 miles).
Take-off run 250 m. (273 yds.).
Landing run 200 m. (218 yds.).



The Pasotti F.9 Sparviero (250 h.p. Hirth HM.508 engine).

PIAGGIO

PIAGGIO & C., SOCIETA' PER AZIONI.

HEAD OFFICE: VIA ANTONIO CECCHI 6, GENOA (434).

BRANCH OFFICES: ROME AND MILAN.

WORKS: FINALE-LIGURE, PONTEDERA, PISA AND GENOA-SESTRI.

Managing Directors: Ing. Armando Piaggio and Dr. Enrico Piaggio.

Technical Directors: Ing. Filippo Schiaffino (Railway Division), Ing. Corradino D'Ascanio (Automotive Division), and Ing. Giovanni P. Casiraghi (Aircraft Division) and Ing. Guido Ferraris (Engine Division).

This famous engineering firm began the construction of aeroplanes in its Genoa-Sestri plant in 1916, and later in the Finale-Ligure works. In 1938 Plant No. 2 at Pontedera was built for the construction of large multi-engined all-metal aircraft. At the Finale-Ligure plant the Piaggio company operates the first (1930) privately-owned wind tunnel and the only privately-owned water tank for seaplane model testing in Italy.

The company's first post-war products were the Piaggio P.136 twin-engined amphibian flying-boat, twenty-three of which have been supplied to the Italian Air Force for training and coastal reconnaissance; and the P.148 two-seat primary trainer, which has been adopted as a standard type by the Italian Air Force. Over 80 P.148's have been built.

A licence to manufacture the P.136 amphibian in the United States has been acquired by the Trecker Aircraft Corporation. Trecker is assembling Italian-built aircraft and marketing them throughout North America under the name of "Royal Gull." Nearly 50 P.136's have been built.

The P.150 two-seat basic trainer, which made its first flight in October, 1952, has been described in earlier editions of "All the World's Aircraft." The prototype of the P.149-D cabin monoplane derived from the P.148, of which it uses many structural parts, flew in July, 1953.

In 1955, the P.149-D was chosen for liaison and training duties with the new German Air Force. Seventy-five of these aircraft will be delivered by Piaggio; while the remainder will be built under licence in Germany by Focke-Wulf.

A more powerful version of the P.136 amphibian, designated P.136-L-2, appeared early in 1956. Under development are a medium-sized amphibian, designed as the P.155-AS for anti-submarine duties, the P.155-SAM for air-sea rescue and the P.155-CT civil transport; and a six to eight-seat twin-engined executive landplane designated the P.166. Details of these aircraft are given hereafter.

THE PIAGGIO P.166.

Generally similar in layout to the P.136 amphibian, the P.166 will be a six to eight-seat executive landplane, powered by two supercharged 340 h.p. Lycoming GSO-480-A1 engines. As in the P.136, the engines will be mounted at the "knuckles" of the cranked high wings, driving pusher airscrews. The fuselage will be longer than that of the P.136, and wing-tip fuel tanks will be fitted. The prototype was expected to fly during 1957.

WEIGHTS.—
Weight empty 2,100 kg. (4,630 lb.).
Weight loaded 3,200 kg.(7,050 lb.).

PERFORMANCE (estimated).—
Max. speed 380 km.h. (236 m.p.h.).
Max. cruising speed 330 km.h. (205 m.p.h.).
Economic cruising speed 285 km.h. (177 m.p.h.).
Service ceiling 7,680 m. (25,200 ft.).
Single-engine ceiling 3,410 m. (11,200 ft.).
Take-off distance to clear 15 m. (50 ft.) 480 m. (1,580 ft.).
Landing distance from 15 m. (50 ft.) 500 m. (1,640 ft.).
Max. range 2,500 km. (1,520 miles).

THE PIAGGIO P.155.

The Piaggio P.155 is a large twin-engined amphibian, the prototype of which is due for completion during 1959. It is of conventional high-wing monoplane layout, with the tailplane mounted mid-way up its slightly-swept-back fin. The hull is of conventional form, with a single step and long after-body; and there is a fixed stabilising float under each outer wing.

Three versions of the P.155 have been announced:—

P.155-SAM.1. Sea rescue version with a crew of seven and accommodation for ten stretcher cases and 5-10 other passengers. Two Pratt & Whitney R-2800 piston-engines. Designed to cruise at 260-350 km.h. (160-220 m.p.h.), with a maximum range of approximately 3,700 km. (2,300 miles).

P.155-AS. Naval reconnaissance and anti-submarine version. Reported to be designed with two turboprop engines and auxiliary turbojets.

P.155-CT. Commercial transport with accommodation for 20-30 passengers. Will have two turboprops in 3,000-4,000 h.p. category.

No further details are available.

THE PIAGGIO P.149-D.

The P.149-D was developed from the P.148 and uses many of the same structural components. The prototype flew in July, 1953. Two years later the P.149-D was chosen for liaison and training duties with the German Air Force, and will be built under licence by the Focke-Wulf company in Germany.

TYPE.—Four-five seat Cabin Utility/Two-seat Aerobatic monoplane.

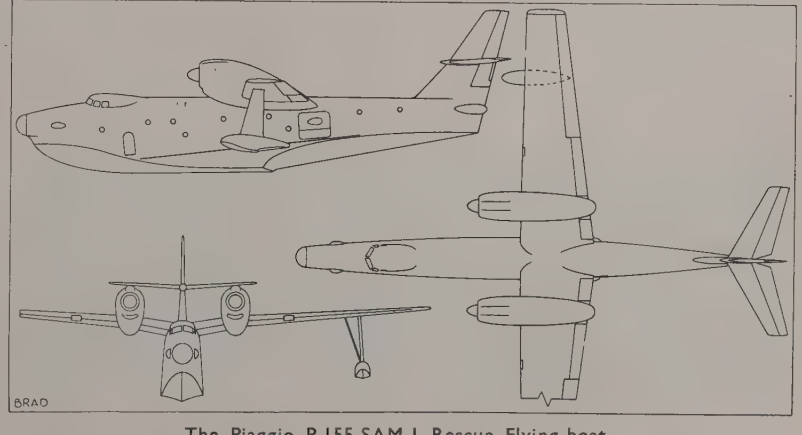
WINGS.—Same as for P.148.

FUSELAGE.—Oval section all-metal monocoque of similar construction to P.148.

TAIL UNIT.—Same as for P.148.

LANDING GEAR.—Retractable nose-wheel type. Electric retraction, with emergency manual operation. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes. Track 3.15 m. (10 ft. 4 in.). Wheelbase 2.03 m. (6 ft. 8 in.).

POWER PLANT.—One 270 h.p. Lycoming GO-480 six-cylinder horizontally-opposed geared air-cooled engine. Piaggio P.1033 three-blade constant-speed airscrew. Four fuel tanks in wings. Total fuel capacity 240 litres (52.8 Imp. gallons=63.4 U.S. gallons). Oil capacity 11.3 litres (2.5 Imp. gallons=3.0 U.S. gallons).



The Piaggio P.155-SAM.1 Rescue Flying-boat.

ACCOMMODATION.—Enclosed cabin containing two front seats with dual controls and a wide rear seat for 2-3 persons. Canopy slides backward for access and can be released in flight for emergency exit when the aircraft is used for aerobatics. Large baggage compartment behind rear seat. Complete blind-flying and navigation instrumentation, including radio and D/F.

DIMENSIONS.—
Span 11.12 m. (36 ft. 6 in.).
Length 8.80 m. (28 ft. 9½ in.).
Height 2.90 m. (9 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,160 kg. (2,557 lb.).
Disposable load 520 kg. (1,147 lb.).
Weight loaded 1,680 kg. (3,704 lb.).
Wing loading 89.3 kg./m.² (18.2 lb./sq. ft.).
Power loading 6.20 kg./h.p. (13.7 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 304 km.h. (192 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 285 km.h. (177 m.p.h.).
Cruising speed at 2,300 m. (7,500 ft.). at 67% METO power 266 km.h. (165 m.p.h.).
Stalling speed at S/L. (with flaps) 92 km.h. (57 m.p.h.).
Initial rate of climb 300 m./min. (980 ft./min.).
Service ceiling 6,050 m. (19,800 ft.).
Range (including allowance for starting, warm-up, take-off and climb, plus ½ hour reserve) at 3,300 m. (10,800 ft.) and with full tanks 1,090 km. (680 miles).
Take-off run (no wind) to clear 15 m. (50 ft.) 405 m. (1,328 ft.).
Landing run (no wind) from 15 m. (50 ft.) 315 m. (1,033 ft.).

THE PIAGGIO P.148.

TYPE.—Three-seat Primary/Two-seat Aerobatic Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section derived from NACA 230 and 4412. Aspect ratio 6.6. Taper ratio 2 :1. Dihedral 6°. All-metal aluminium-alloy riveted single-spar structure with smooth skin covering. All-metal slotted ailerons and flaps. Total flap area 2.18 m.² (23.6 sq. ft.). Total aileron area 1.52 m.² (16.4 sq. ft.). Gross wing area 18.81 m.² (203 sq. ft.).

FUSELAGE.—Circular section structure. Aluminium-alloy stressed skin monocoque.

TAIL UNIT.—Cantilever monoplane type. Aluminium-alloy riveted structure. Fin area 0.66 m.² (7.1 sq. ft.). Rudder area 0.84 m.² (9 sq. ft.). Tailplane area 2.02 m.² (21.7 sq. ft.). Total elevator area 1.52 m.² (16.4 sq. ft.).

LANDING GEAR.—Non-retractable tail-wheel type. Oleo-pneumatic shock absorbers. Hydraulically operated wheel-brakes. Steerable tail-wheel. Track 2.90 m. (9 ft. 6 in.). Wheelbase 5.40 m. (17 ft. 9 in.).

POWER PLANT.—One 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine driving a Piaggio P.1032 two-blade metal constant-speed airscrew. Two fuel tanks in wings, one on each side of fuselage, with total capacity of 169 litres (37 Imp. gallons).

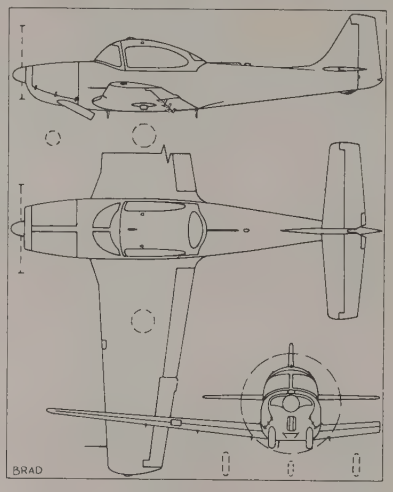
ACCOMMODATION.—Two seats side-by-side with complete dual controls, and optional third seat aft, all enclosed by transparent bubble canopy. Rear part of canopy slides backwarus for access and may be released in flight for emergency exit. Reinforced front windshield frame protects crew in event of nose-over landing.

DIMENSIONS.—
Span 11.12 m. (36 ft. 6 in.).
Length overall 8.44 m. (27 ft. 8 in.).
Height overall 2.40 m. (7 ft. 10½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 876 kg. (1,931 lb.).
Disposable load (two-seater) 324 kg. (714 lb.).

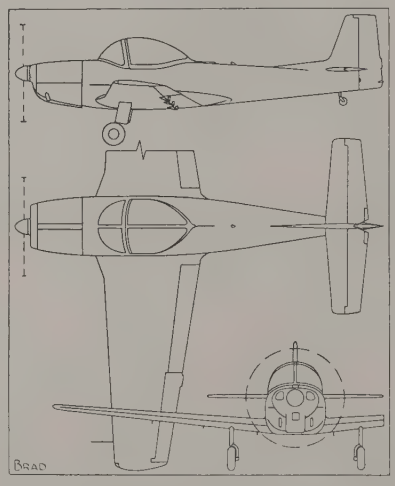


The Piaggio P.149 (270 h.p. Lycoming GO-480 engine).



The Piaggio P.149.

Disposable load (three-seater) 404 kg. (891 lb.).
Gross weight (two-seater) 1,200 kg. (2,645 lb.).
Gross weight (three-seater) 1,280 kg. (2,822 lb.).
Wing loading (two seater) 63.8 kg./m.² (13.1 lb./sq. ft.).
Wing loading (three-seater) 68.0 kg./m.² (13.9 lb./sq. ft.).



The Piaggio P.148 Trainer.



The Piaggio P.148 Trainer (190 h.p. Lycoming O-435-A engine).

Power loading (two-seater) 6.32 kg./h.p. (13.9 lb./h.p.).
Power loading (three-seater) 6.74 kg./h.p. (14.9 lb./h.p.).

PERFORMANCE (two-seater aerobatic).—
Max. speed at sea level 234 km.h. (145.4 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 223 km.h. (138.6 m.p.h.).
Max. speed at 4,000 m. (13,120 ft.) 200 km.h. (124.3 m.p.h.).
Cruising speed at 900 m. (2,953 ft.) 204 km.h. (126.8 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min. 40 sec.
Climb to 2,000 m. (6,560 ft.) 8 min. 10 sec.
Climb to 3,000 m. (9,840 ft.) 15 min. 40 sec.
Climb to 4,000 m. (13,120 ft.) 26 min. 40 sec.
Service ceiling 5,000 m. (16,400 ft.).
Take-off run (no wind) 135 m. (443 ft.).
Landing run 150 m. (492 ft.).
Landing speed 80 km.h. (49.7 m.p.h.).
Duration (full tanks) 4.5 hours.
Range (including starting, warming up, take-off and climb) 923 km. (573 miles).

PERFORMANCE (three-seater).—
Max. speed at sea level 232 km.h. (144.2 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 220 km.h. (137.3 m.p.h.).
Max. speed at 4,000 m. (13,120 ft.) 198 km.h. (123.0 m.p.h.).
Cruising speed at 900 m. (2,953 ft.) 201 km.h. (124.9 m.p.h.).
Landing speed 83 km.h. (51.6 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 4 min. 30 sec.
Climb to 2,000 m. (6,560 ft.) 11 min. 0 sec.
Climb to 3,000 m. (9,840 ft.) 19 min. 0 sec.
Service ceiling 4,400 m. (14,436 ft.).
Duration (full tanks) 4 hours.
Range (including allowance for starting, warming up, take-off and climb) 800 km. (497 miles).
Take-off run (no wind) 194 m. (636 ft.).
Landing run 180 m. (591 ft.).

THE PIAGGIO P.136-L-1 and L-2.

In production for the Italian Air Force as an air/sea rescue amphibian, the P.136 is now available in two forms, the P.136-L-1 and P.136-L-2, which differ only in their power plants. Both are being marketed in the United States by the Trecker Aircraft Corporation as the Royal Gull.

The original P.136-L version is no longer in production, but has been described in earlier editions of this work.

TYPE.—Twin-engined Five-seat Amphibian Flying-boat.

WINGS.—High-wing gull-shaped cantilever monoplane. NACA 230 wing section. Aspect ratio 7.4. Dihedral —21° 30′ inner gull portion, +2° 5′ outer wing. Chord 2.40 m. (7 ft. 10½ in.) root, 1.15 m. (3 ft. 9¼ in.) tip. All-metal aluminium-alloy riveted structure. Single-spar box type, smooth skin covering. All-metal slotted trailing-edge flaps. Metal-framed fabric-covered slotted ailerons. Total flap area 2.38 m.² (25.6 sq. ft.). Total aileron area 1.95 m.² (21 sq. ft.). Gross wing area 25.1 m.² (270.2 sq. ft.).

HULL.—Two-step type. All-metal plated aluminium-alloy riveted semi-monocoque structure. Side floats attached to wing by single streamline strut. Retractable water rudder.

TAIL UNIT.—Cantilever monoplane type. All-metal plated aluminium-alloy riveted structure. Tailplane and fin covered with smooth metal skin. Elevators and rudder fabric-covered. Trimming tabs in elevators and rudder. Fin area 1.81 m.² (19.5 sq. ft.), rudder area 0.77 m.² (8.3 sq. ft.), total elevator area 2.55 m.² (27.4 sq. ft.), tailplane area 2.82 m.² (30.5 sq. ft.).

LANDING GEAR.—Retractable type. Hydraulically operated. Oleo-pneumatic shock absorbers. Hydraulic wheel brakes. Track 2.54 m. (8 ft. 4 in.). Wheelbase 5.72 m. (18 ft. 9 in.).

POWER PLANT (P.136-L-1).—Two 270 h.p. Lycoming GO-480-B geared engines. Three-blade Piaggio P.1033 or Hartzell HC-83X20-2AL constant-speed full-feathering airscrews. Two fuel tanks in hull with total capacity of 720 litres (158.4 Imp. gallons = 190.3 U.S. gallons).

POWER PLANT (P.136-L-2).—Two 340 h.p. Lycoming GSO-480 geared and supercharged engines. Otherwise as P-136-L-1.

ACCOMMODATION.—Enclosed cabin seating two side-by-side in front and three on large seat aft. Dual controls. Two side doors. Right-hand panel of windshield fully openable for mooring, etc.

DIMENSIONS.—
Span 13.53 m. (44 ft. 4.7 in.).
Length overall 10.80 m. (35 ft. 5 in.).
Height overall 3.83 m. (12 ft. 7 in.).

WEIGHTS AND LOADINGS (P.136-L-1).—
Weight empty 1,996 kg. (4,400 lb.).
Disposable load 724 kg. (1,596 lb.).
Weight loaded 2,720 kg. (5,996 lb.).
Wing loading 108.5 kg./m.² (22.2 lb./sq. ft.).
Power loading, take-off, 5.04 kg./h.p. (11.1 lb./h.p.).



The Piaggio P.136-L-1 Amphibian (two 270 h.p. Lycoming GO-480-B engines).

WEIGHTS AND LOADINGS (P.136-L-2).—
Weight empty 2,110 kg. (4,652 lb.).
Disposable load 884 kg. (1,948 lb.).
Weight loaded 2,994 kg. (6,600 lb.).
Wing loading 119.3 kg./m.² (24.4 lb./sq. ft.).
Power loading, take-off, 4.4 kg./h.p. (9.7 lb./h.p.).



The Piaggio P.136-L-2 Amphibian (two 340 h.p. Lycoming GSO-480 engines).

PERFORMANCE (P.136-L-1 at 2,720 kg. = 5,996 lb. gross weight).—
Max. speed at S/L 294 km.h. (182.7 m.p.h.).
Cruising speed (70% rated power) 268 km.h. (167 m.p.h.) at 2,800 m. (9,000 ft.).
Stalling speed (with flaps) 110 km.h. (68.4 m.p.h.).
Service ceiling 6,000 m. (19,685 ft.).
Service ceiling (one engine) 1,500 m. (5,000 ft.).
Range (payload 355 kg. = 783 lb.) 950 km. (590 miles).
Max. range (55% rated power, full tanks) 1,700 km. (1,056 miles).

PERFORMANCE (P.136-L-2 at 2,994 kg. = 6,600 lb. gross weight).—
Max. speed at S/L. 335 km.h. (208 m.p.h.).
Cruising speed (70% rated power) at 4,100 m. (13,500 ft.) 306 km.h. (190 m.p.h.).
Stalling speed (with flaps) 116 km.h. (72 m.p.h.).
Service ceiling 7,800 m. (25,500 ft.).
Service ceiling (one engine) 3,600 m. (11,800 ft.).
Range (50% power) at 4,300 m. (14,000 ft.) 1,450 km. (900 miles).

SIAI-MARCHETTI

SOCIETÀ PER AZIONI SIAI-MARCHETTI.

REGISTERED OFFICE: VIA DELLA POSTA, 3, MILAN.

MANAGEMENT AND WORKS: SESTO CALENDE (VARESE).

AERODROME: VERGIATE (VARESE).

ROME OFFICE: VIA PUCCINI, 10.

The Siai-Marchetti company, formerly known as Savoia-Marchetti, has produced a wide range of military and civil aircraft covering both landplanes and flying-boats.

After the War the Company built the SM.95 four-engined commercial monoplane, and the SM.102 twin-engined short-range passenger monoplane. Both these aircraft have been fully described and illustrated in previous editions of "All the World's Aircraft."

After suffering heavy financial losses owing to lack of government orders, Siai-Marchetti went into liquidation in September, 1951. By the beginning of 1953 the company had practically overcome its financial difficulties, withdrew the liquidation and obtained several orders covering the full capacity of the aircraft works.

In the aircraft field, the company is overhauling and repairing various types of aircraft for the Italian Air Force and other countries.

JAPAN

FUJI

FUJI JUKOGYO KABUSHIKI KAISHA. (Fuji Heavy Industries Ltd.).

HEAD OFFICE: No. 18, 2-CHOME, MARUNOUCHI, CHIYODA-KU, TOKYO.

AIRCRAFT FACTORY: UTSUNOMIYA CITY, TOCHIGI PREFECTURE.

AERO-ENGINE FACTORIES: MITAKA, TOKYO; OMIYA CITY, SAITAMA PREFECTURE.

President and Director: Takao Yoshida.

Chairman: Kijio Kishi.

Managing Directors: Tadashi Miki, Toshio Inoue, Tomizo Fujiu, Takeo Kotani and Toshio Matsubayashi.

Fuji Heavy Industries Ltd. was established on July 15, 1953, and is essentially a successor to the Nakajima Aircraft Company, a pioneer in the field of aviation in Japan, established in 1914.

At the end of the last war, the Nakajima company was disbanded and the head office converted into the Fuji Sangoyo Kabushiki Kaisha with the function of liquidating the various properties held by Nakajima. At the same time, secondary companies were formed around the former Nakajima plants with the purpose of engaging in the production of peacetime products.

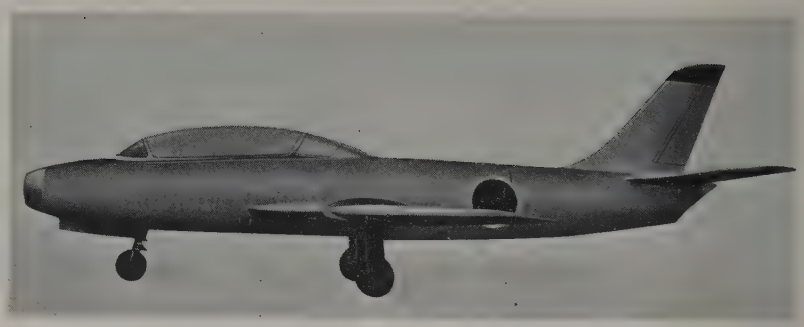
When the restrictions on aircraft manufacture were lifted, five of the major secondary companies established the Fuji Heavy Industries Ltd. in July, 1953, and in April, 1955 this company incorporated the five separate companies into its organisation.

Under a licence and technical assistance agreement with the Beech Aircraft Corporation, concluded in 1953, Fuji is building the Beechcraft Mentor at the Utsunomiya plant for the Japan Air Self-Defence Forces. Beginning deliveries in August, 1954, Fuji now has a production capacity of 12 Mentors per month. Exports of this aircraft to the air forces of various Asian countries are anticipated.

A modified version of the Mentor with both military and civil uses has been developed as the LM-1 Nikko, and this aircraft is now in quantity production for liaison duties with the Japan Ground Self-Defence Forces.

Fuji have also signed a licence agreement with Cessna Aircraft Company under which they will build a total of 180 Cessna L-19 liaison aircraft in Japan, with first deliveries due in 1958.

First aircraft designed entirely by Fuji is the T1F1 swept-wing intermediate two-seat jet trainer, of which two prototypes were scheduled for completion in 1957, to be followed by quantity production for the Japan Air Self Defence Forces.



The final mock-up of the Fuji T1F1 Jet Trainer.

THE FUJI T1F1.

The Fuji T1F1 has been chosen by the Japanese National Defense Agency as a replacement for the North American T-6G basic training aircraft, following a design competition for which the Shin Meiwa and Kawasaki companies also prepared design studies. Initial orders cover the manufacture of three T1F1's, and present plans call for a follow-up contract for four more in fiscal 1957 and the initiation of quantity production in 1958. The first prototype is scheduled to fly late in 1957.

Powered initially by a Bristol Orpheus and later by a Japanese-designed J-3 turbojet, the T1F1 will be a tandem two-seat trainer of conventional low-wing monoplane layout, with pressurised cabin, ejection seats and complete dual instrumentation. Its wings and tail surfaces will be moderately swept-back, the landing gear will be retractable and it will have a nose air intake. Wing area will be 22 m.² (236.8 sq. ft.).

DIMENSIONS.—
Span 10.50 m. (34 ft. 6 in.).
Length 11.98 m. (39 ft. 4 in.).

WEIGHT.—
Weight loaded 3,300 kg. (7,275 lb.).

PERFORMANCE (Orpheus engine).—
Max. speed 798 km.h. (496 m.p.h.).
Take-off field length 388 m. (1,273 ft.).

THE FUJI MODEL LM-1 NIKKO.

Freely adapted from the basic Model B-45 Mentor airframe, the new Model LM-1 Nikko differs only in interior modifications, including accommodation for four to five and an extra wing fuel tank of 10 U.S. gallons (38 litres). Dispensing with additional military training equipment has resulted in lower design weights and increased payload and gross loaded weight. Flying speeds are reduced and the general performance is lower.

The first of 24 Nikko liaison aircraft ordered under U.S. off-shore procurement for the Japan Ground Self Defence Force was delivered on October 3, 1956.

TYPE.—Four to five seat general-purpose single-engine Cabin Monoplane.

WINGS.—As Model B-45 Mentor.

FUSELAGE.—As Model B-45 Mentor except for modifications listed under "Accommodation."

TAIL UNIT AND LANDING GEAR.—As Model B-45 Mentor.

POWER PLANT.—As Model B-45 Mentor. Additional to the two B-45 wing tanks of 25 U.S. gallons each (total 190 litres) is a third wing tank of 10 U.S. gallons (38 litres).

ACCOMMODATION.—Enclosed cabin seating a maximum of five; pilot in front on port side with conventional wheel control system, and three passengers, one beside the pilot and two side-by-side at back of cabin. An additional auxiliary seat may be installed between the front and rear main seats. Maximum interior width of cabin 1.04 m. (41 in.) as against the 0.914 m. (36 in.) of the Model B-45 Mentor. Access door on the starboard side. Rear windows open for ground ventilation. Cabin structure is reinforced for protection against turn-overs. A large portion of the roof structure is easily removable for access to the cabin when loading bulky cargoes. Provisions have been incorporated in the design for the LM-1 to be quickly adapted for photographic survey, ambulance and light cargo duties. Complete side-by-side dual controls can also be provided.

DIMENSIONS (As Model B-45 Mentor).

WEIGHTS AND LOADINGS.—
Weight empty (full equipped) 945 kg. (2,080 lb.).
Useful load 525 kg. (1,165 lb.).
Useful load (max.) 655 kg. (1,447 lb.).
Weight loaded (normal) 1,470 kg. (3,245 lb.).
Weight loaded (max.) 1,600 kg. (3,527 lb.)
Wing loading 89.1 kg.m.² (18.26 lb./sq. ft.).
Power loading (fully loaded) 6.54 kg./h.p. (14.4 lb./h.p.).

PERFORMANCE (Gross weight 1,470 kg.).—
Max. speed at S/L. 297 km.h. (185 m.p.h.).
Cruising speed 239 km.h. (148 m.p.h.) at 910 m. (3,000 ft.).
Stalling speed (flaps down) 85 km.h. (53 m.p.h.).
Rate of climb at S/L. 302 m./min. (990 ft./min.).
Time to 1,525 m. (5,000 ft.) 6 min.
Time to 3,050 m. (10,000 ft.) 15 min. 45 sec.
Service ceiling 4,575 m. (15,000 ft.).
Take-off run 178 m. (584 ft.).
Take-off distance to clear 15 m. (50 ft.) 501 m. (1,642 ft.).
Landing run 164 m. (538 ft.).
Landing distance from 15 m. (50 ft.) 339 m. (1,110 ft.).
Cruising range 1,440 km. (895 miles) at 910 m. (3,000 ft.).



The Fuji Model LM-1 Nikko (225 h.p. Continental O-470 engine).

KAWASAKI

KAWASAKI KOKUKI KOGYO KABUSHIKI KAISHA (Kawasaki Aircraft Co., Ltd.).

HEAD OFFICE: 100, KANINOSAKA, AKASHI.

WORKS: GIFU AND AKASHI.

The former Kawasaki Kikai Kogyo Kabushiki Kaisha and Kabushiki Kaisha Kawasaki Gifu Seisakusho were amalgamated under the name Kawasaki Kokuki Kogyo Kabushiki Kaisha (Kawasaki Aircraft Co., Ltd.) on March 15, 1954.

Kawasaki has signed a contract with the Lockheed Aircraft Service (Overseas) whereby it is permitted to repair and overhaul and, ultimately, manufacture the Lockheed F-94C all-weather fighter and the T-33A trainer. Under its terms, Kawasaki is assembling 180 T-33A's for the Japanese Self-Defence Air Forces. The first of these flew in January, 1956.

Kawasaki has a licence to build the Bell Model 47 helicopter, and is also engaged in the manufacture of aircraft of original design. Its first post-war products, the KAL-2 and KAT-1, have been described and illustrated in previous editions of this Annual.

MITSUBISHI

SHIN MITSUBISHI JUKOGYO KABUSHIKI KAISHA (Mitsubishi Heavy Industries, Reorganized, Ltd.).

HEAD OFFICE: No. 1, 7-CHOME, WADAMIYA-DORI, HYOGO-KU, KOBE.

AIRCRAFT DEPARTMENT HEAD OFFICE: No. 14, 2-CHOME, MARUNOUCHI, CHIYODA, TOKYO.

President: Shinzo Fujii.

Vice-President: Taizo Shoda.

Manager, Aircraft Department: Iwataro Nakagawa.

Mitsubishi began the production of aircraft in the present Oye plant of its Nagoya Engineering Works in 1920, and manufactured a total of 80,000 aircraft of approximately one hundred different types during the 25 years prior to the termination of World War II in 1945.

The company was also one of the most outstanding aero-engine manufacturers in Japan, and produced a large number of engines in the 1,000-2,500 h.p. range.

The conclusion of the Peace Treaty in 1952 enabled the aircraft industry in Japan to recommence, and in December of that year the company constructed its present Komaki aircraft plant, adjacent to the Airbase of the United States Air Force. This plant has a total area of 3,060,000 square feet, and building area of 288,000 square feet. The overhaul of F-86 fighters for the United States Far East Air Forces was started in March, 1953.

The Komaki Plant is also carrying out the overhaul and repair of Sikorsky S-55 helicopters for the Japanese Defence Agency and others, under a technical assistance agreement for parts manufacture and repair concluded with the United Aircraft Corporation, Sikorsky Aircraft Division.



The first North American F-86F assembled by Mitsubishi.

The construction of an Aero-engine Overhaul Shop in the Daiko Plant was completed in the Spring of 1952, and over 250 engines have already been overhauled for the Japan Air Lines, Northwest Air Lines, Japanese Defence Agency, and other domestic and overseas clients. This work is being done under a technical assistance agreement on parts production and repair concluded with the United Aircraft Corporation, Pratt & Whitney Aircraft Division. It includes various types of engines such as R-985 (450 h.p.) R-1340 (600 h.p.), R-1830 (1,200 h.p.), R-2000 (1,450 h.p.) and R-2800 (2,500 h.p.).

Following the conclusion of an agreement between the United States and the Japanese Governments in June, 1955, for the manufacture in Japan of jet aircraft, the company is assembling a total of 300 F-86F fighters, under a complete licence agreement with North American Aviation Inc. This work is being carried out in the company's Komaki and Oye plants and involves the manufacture of some 77% of the airframe components, the remainder being supplied by the parent company. The first aircraft of this programme was flown on August 9, 1956. After the completion of this programme, the company will advance to the complete design and manufacture of new aircraft, and for this purpose has already added to its extensive production facilities a wind-tunnel laboratory and a structure test shop at its Oye plant.

Mitsubishi is also engaged on the development of guided weapons.

SHOWA

SHOWA HIKOKI KOGYO KABUSHIKI KAISHA (Showa Aircraft Industry Co., Ltd.).

HEAD OFFICE: No. 1, 2-CHOME, NIHONBASHI - MUROMACHI, CHUO - KU, TOKYO.

WORKS: No. 600, TANAKA-MACHI, AKISHIMA-CITY, TOKYO, AND No. 898, OHGAMI-MACHI, AKISHIMA-CITY, TOKYO.

President: Kanoh Hironaka.

Executive Director: Shinji Iwabuchi.

Managing Director: Kiyoshi Maekawa.

Showa, which, before the war, was responsible for the manufacture of the Douglas DC-3 under licence, was the first Japanese aircraft manufacturing company to resume post-war operations when it undertook the overhaul and repair of aircraft of the Far East Air Force under contract with the U.S. Government.

While continuing with the overhaul and repair of U.S.A.F. aircraft, helicopters and aero-engines, the company has erected a new factory and is making preparations for the production of some kind of aircraft, in addition to continuing the repair and maintenance work.

TACHIKAWA

SHIN TACHIKAWA KOKUKI KABUSHIKI KAISHA (New Tachikawa Aircraft Co., Ltd.).

HEAD OFFICE: 1-100 TAKAMATSU-CHO, TACHIKAWA, TOKYO.

FACTORIES: TACHIKAWA AND SUNAGAWA.

President: Yoshio Kawasaki.

The New Tachikawa Aircraft Company was established on November 15, 1949, as the second reconstructed company of the former Tachikawa Aircraft Co., Ltd.

As all the factory area of the former company has been in use by the U.S. Air Force since September 4, 1945, Tachikawa has built a new factory at Sunagawa, outside the original factory area.

As soon as the Air Law permitting the manufacture of aircraft was published on July 15, 1952, the company began the design of its first aeroplane, the R-52. This was completed in September, 1952 and was the first aircraft built entirely of Japanese materials and powered by a Japanese engine to be completed since the war.

A revised version, the R-53, has since been built and is described hereunder.



The Tachihi R-53 (155 h.p. Blackburn Cirrus Major engine).

THE TACHIHI R-53.

TYPE.—Two-seat Trainer.

WINGS.—High-wing strut-braced monoplane. NACA 23012 wing section. Aspect ratio 6.62. Dihedral nil. Two Japanese cypress spars, pressed duralumin ribs and fabric covering. No flaps or slots. Gross wing area 17.3 m.² (186 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with fabric.

TAIL UNIT.—Strut-braced monoplane type. Welded steel tube framework with fabric covering. Trim-tab in elevator. Areas: fin 0.7 m.² (7.54 sq. ft.), rudder 1.03 m.² (11.09 sq. ft.), horizontal tail area 2.5 m.² (26.9 sq. ft.). Tailplane span 3.376 m. (11 ft.).

LANDING GEAR.—Fixed tail-wheel type. Oil spring shock-absorber struts. Wheel brakes. Steerable tail-wheel with spring steel shock-absorber.

POWER PLANT.—One 155 h.p. Blackburn Cirrus Major four-cylinder in-line inverted air-cooled engine. Two-blade fixed-pitch wood airscrew 2.04 m. (6 ft. 8 in.) diameter. Fuel tank (140 litres=30.8 Imp. gallons) in centre-section of wing.

ACCOMMODATION. — Tandem open cockpits with dual controls.

DIMENSIONS.—
Span 10.7 m. (35 ft. 1 in.).
Length 7.55 m. (24 ft. 9 in.).
Height 2.65 m. (8 ft. 8 in.).

WEIGHTS.—
Weight empty 668 kg. (1,473 lb.).
Disposable load 282 kg. (622 lb.).
Weight loaded 950 kg. (2,095 lb.).

PERFORMANCE.—
Max. speed 208 km.h. (129 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Stalling speed 79 km.h. (49 m.p.h.).
Service ceiling 4,350 m. (14,270 ft.).
Range 750 km. (466 miles).
T.O. distance to 15 m. (50 ft.) 421 m. (461 yds.).
Landing distance from 15 m. (50 ft.) 466 m. (510 yds.).

THE TACHIHI R-HM.

The R-HM was built under the direction of M. Henri Mignet, the designer of the controversial Pou-du-Ciel. Although the R-HM is similar in external appearance to the H.M.310 which M. Mignet built in Brazil in 1950, it is claimed that the Japanese version is improved in many respects.

TYPE.—Two-seat light aircraft.

WINGS.—Consist of surfaces of unequal span so positioned to provide a slot or gap effect

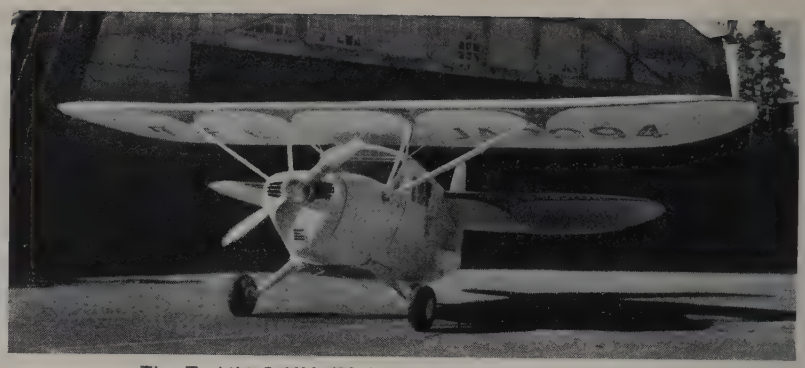
between the trailing-edge of the forward wing and the leading-edge of the rear wing. Forward wing has variable incidence controllable by direct connection with the control column. Rear wing is fixed but provided with trailing-edge trimming surface of 0.31 m.² (3.34 sq. ft.) area. NACA 23012 (modified) wing section on both surfaces. Chord (both surfaces) 1.50 m. (4 ft. 11 in.). Both surfaces are single-spar fabric-covered structures. Outer sections of both wings hinged to fold up for storage. Gross wing area 18.72 m.² (201.5 sq. ft.).

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Vertical rudder only. Area 0.9 m.² (9.68 sq. ft.).

LANDING GEAR.—Fixed type. Rubber-cord springing. Goodyear wheels and brakes. Steerable tail-wheel.

POWER PLANT.—One 90 h.p. Continental C90-12F four-cylinder horizontally-opposed air-cooled engine. Met-L-Prop two-blade airscrew. Fuel tank (100 litres = 22 Imp. gallons) in fuselage.



The Tachihi R-HM (90 h.p. Continental C90 engine).

ACCOMMODATION.—Enclosed cockpit seating two side-by-side.

DIMENSIONS.—
Span of front wing 8.0 m. (26 ft. 3 in.).
Span of rear wing 5.76 m. (18 ft. 11 in.).
Overall length 5.08 m. (16 ft. 8 in.).
Height 2.00 m. (6 ft. 7 in.).

WEIGHTS.—
Weight empty 413 kg. (911 lb.).
Weight loaded 645 kg. (1,422 lb.).

PERFORMANCE.—
Cruising speed 115 km.h. (71.5 m.p.h.).
Landing speed 50 km.h. (31.1 m.p.h.).

TOYO

TOYO KOKU KABUSHIKI KAISHA (Toyo Aircraft Industry Company Ltd.).

HEAD OFFICE: 9 RAPPONGI, AZABU, MINATO-KU, TOKYO.

WORKS: TOFSUKA, YOKOHAMA.

ASSEMBLY SHOP AND AIRSTRIP: OHARA FUJISAWA, KANAGAWA PREFECTURE.

President: Shigemi Yokoo.

Vice-President and Managing Director: Shingo Ishikawa.

Director of Technical Services and Chief Engineer: Yoshio Hashiguchi.

The Toyo Aircraft Manufacturing Company was formed on June 10, 1952, by Shigemi Yokoo, a former Minister of International Trade and Industry; Shingo Ishikawa, a former admiral of the Imperial Japanese Navy; and Yoshio Hashiguchi, who was formerly managing director and chief engineer of the Kawasaki Aircraft Company.

The company's first aircraft, the Type TT-10, made its first flight on December 30, 1952. This aircraft has been described and illustrated in previous issues of this Annual.

Toyo holds the manufacturing and sales licences for the FD-25 and FD-25A from the Fletcher Aviation Corporation of Pasadena, California, U.S.A. These aircraft are now in production.

The Fletcher Aviation Corporation is a stock participant in Toyo, as is the Air Carrier Service Corporation of Washington, D.C. The Air Carrier Service Corporation are export representatives for Toyo and also act as purchasing and technical agents for Toyo in the United States.

In addition to building complete aircraft Toyo is engaged in general aircraft overhaul and maintenance work.

NETHERLANDS

AVIOLANDA

AVIOLANDA MAATSCHAPPIJ VOOR VLIEGTUIGBOUW N.V.

HEAD OFFICE: VEERDAM, PAPENDRECHT.

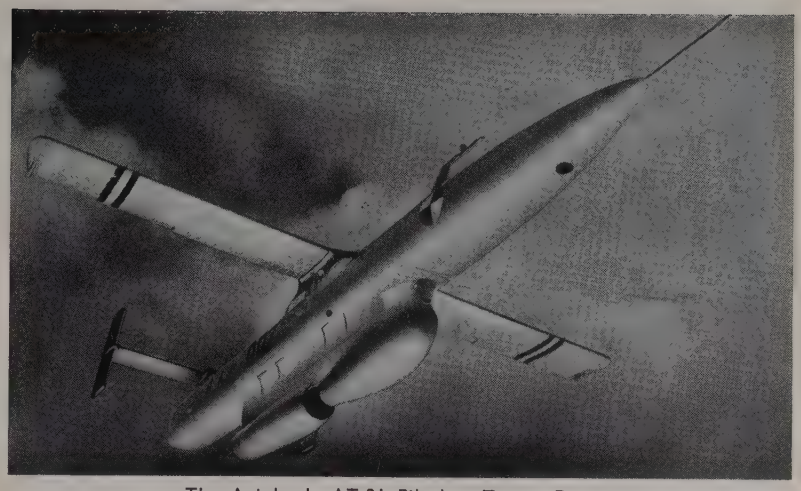
WORKS: PAPENDRECHT, DORDRECHT AND WOENSDRECHT.

Managers: H. A. Burgerhout; J. Goedkoop Dzn.

Assistant Managers: D. van-Leeuwen; J. A. de Vries, M.Sc.

Founded in 1927 by the late Mr. H. Adolph Burgerhout, this company built Dornier flying-boats and Curtiss Hawk fighters under licence pre-war. Its present activities include production under licence of the Hawker Hunter, and development of the AT-21 pilotless electronically-controlled drone aircraft.

Aviolanda is also engaged on extensive overhaul and repair work. Military contracts cover the overhaul and repair of Lockheed Neptune and T-33, North American F-86K, Grumman Avenger, Hiller H-23 and Sikorsky S-55 aircraft. Civil work includes the conversion and re-skinning of Douglas DC-6 transports.



The Aviolanda AT-21 Pilotless Target Drone.

THE AVIOLANDA AT-21 DRONE.

The AT-21 is a pilotless, electronically-controlled aircraft for tactical photographic-reconnaissance, radar training, liaison and gunnery practice. It was designed at the Aviolanda works at Papendrecht and is the first aircraft of its type produced in the Netherlands.

It is ramp-launched with the assistance of booster rockets and controlled in flight from a ground station which contains standard aircraft controls and a cathode-ray tube control panel. Data provided by a telemetry system in the missile and shown on this panel include airspeed, altitude, pitch, roll, incidence, yaw, distance, course and position.

Flight is terminated by actuating the parachute release mechanism. This automatically cuts off the fuel supply and the main electrical power supply and closes all cooling air inlets and exhausts.

After landing, the wing and tail surfaces can be released from the fuselage by explosive bolts. This makes salvage from the water much easier than if the aircraft had to be retrieved in one piece.

TYPE.—Pulse-jet Drone Aircraft.

WINGS.—High-wing cantilever monoplane. Constant chord plastic structure, filled with hard foam plastic. Wings keep afloat after a descent on the water. Metal ailerons. Detachable plastic wing-tips. Provision for wing-tip tanks. Wing area 1.44 m.² (15.5 sq. ft.).

FUSELAGE.—Four-piece structure of circular section. Plastic sandwich nose cone, followed by two light alloy cylindrical sections containing the fuel tank and landing parachutes, and a plastic tail cone.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Construction similar to wings.

POWER PLANT.—SNECMA Type AS.11 pulse-jet (45-70 kg. = 100-150 lb. s.t.) developed by SNECMA from their Ecrevisse unit. Mounted under the fuselage. Fuel capacity 120 litres (24 Imp. gallons).

EQUIPMENT.—Can be fitted with a camera, hit-recorder, markers, flares, etc.

DIMENSIONS.—
Span 3.60 m. (11 ft. 10 in.).
Length 5.50 m. (18 ft.).
Height 1.00 m. (3 ft. 3 in.).

WEIGHTS.—
Weight empty 155 kg. (340 lb.).
Weight loaded 300 kg. (660 lb.).

PERFORMANCE (estimated).—
Max. speed at S/L 330 km.h. (205 m.p.h.).
Max. speed at 3,000 m. (10,000 ft.) 346 km.h. (215 m.p.h.).
Cruising speed at 1,500-3,000 m. (5,000-10,000 ft.) 285 km.h. (177 m.p.h.).
Rate of climb at S/L 370 m./min. (1,200 ft./min.).
Rate of climb at 3,000 m. (10,000 ft.) 190 m./min. (620 ft./min.).
Endurance 60-70 min.

FOKKER

THE N.V. KONINKLIJKE NEDERLANDSE VLIEGTUIGENFABRIEK FOKKER
(Royal Netherlands Aircraft Factories Fokker).

HEAD OFFICE AND MAIN FACTORY: SCHIPHOL-ZUID, AMSTERDAM.

OTHER FACTORIES: AMSTERDAM-NOORD, YPENBURG NEAR THE HAGUE, AND DORDRECHT.

Director in charge of Administration and Finance: H. During.

Technical Director: Prof. ir. E. van Emden.

Sales Director: F. J. L. Diepen.

Assistant Director and Chief Designer: ir. H. C. van Meerten.

The Fokker works at Amsterdam were founded in 1919 by the late A. H. G. Fokker, the well-known aircraft designer, who died on December 23, 1939.

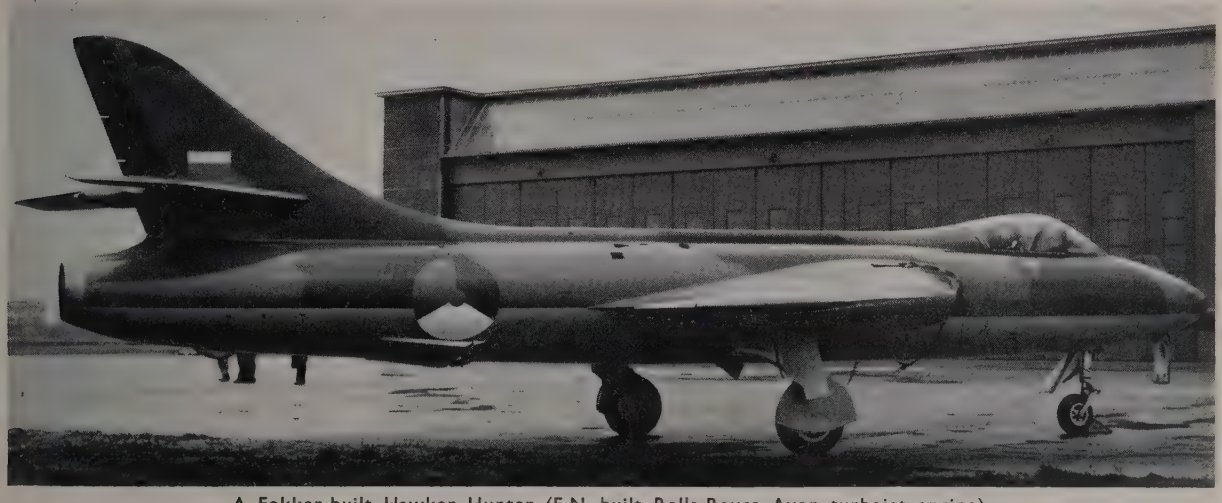
After having rebuilt the war-damaged factory in the north of Amsterdam, a new factory was built in 1951 on the Schiphol Airport, where the main production takes place.

In 1954 the Fokker company enlarged its facilities by the acquisition of the Avio-Diepen Industrie Mij. N.V. at Ypenburg and the former Aviation Section of the "De Schelde" factory at Dordrecht.

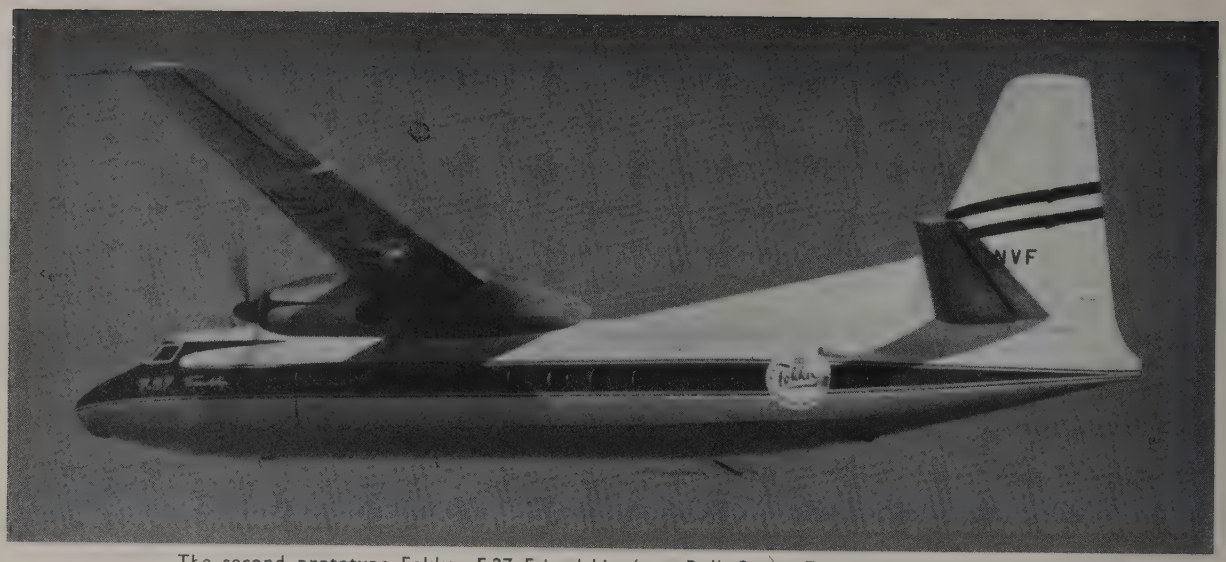
Types of Fokker aircraft built since the war include the S.11 Instructor two-seat basic trainer; the S.12, a nose-wheel version of the S.11; the S.14 Mach-Trainer Mk. I two-seat transition jet trainer powered by a Rolls-Royce Derwent engine; and the S.14 Mach-Trainer Mk. II with the Rolls-Royce Nene engine.

The S.11 Instructor is in service in the Netherlands, Israeli, Brazilian and Italian Air Forces. The Italian Macchi company builds the Instructor under licence under the designation M.416.

In Brazil, Fokker Indústria Aéronautica S.A., with works at the Galeão Airport, Rio de Janeiro, is building a series of 174 S.11 Instructors for the Brazilian Air Force. It will also put into production



A Fokker-built Hawker Hunter (F.N.-built Rolls-Royce Avon turbojet engine).



The second prototype Fokker F.27 Friendship (two Rolls-Royce Dart turboprop engines).

the S.12 and the S.14 Mach-Trainer Mk. I, both in series of fifty.

Current production by Fokker in the Netherlands is concentrated largely on the F.27 Friendship twin-turboprop airliner, with first deliveries scheduled for 1958.

The Fairchild Engine and Airplane Corporation of Hagerstown, Maryland, U.S.A., is manufacturing the Friendship in quantity for the Western Hemisphere, with the exception of Brazil.

In addition, Fokker has signed agreements with the French Breguet and Belgian S.A.B.C.A. companies for mutual close co-operation in technical and commercial matters. S.A.B.C.A. is producing jigs and tools for Fokker, while Breguet, with Sud-Aviation, may produce Friendship components.

Under licence agreements, Fokker has built since the war a series of Hawker Sea Fury fighters for the Royal Netherlands Navy and 330 Gloster Meteor Mk. 8 fighters for the Netherlands and Belgian Air Forces. It is now building a large number of Hunters for Holland and Belgium in close co-operation with the Aviolanda company and the Belgian industry.

THE FOKKER F.27 FRIENDSHIP.

The Friendship has been designed as a medium-sized airliner suitable for short to medium range continental traffic. Two prototypes have been built. The first made its first flight on November 24, 1955, and has accommodation for 28 passengers in a 22.3 m. (73 ft.) long fuselage. It was powered originally by two Rolls-Royce Dart 507 turboprops and later re-engined with Dart 511 turboprops. The second prototype, which flew on January 29, 1957, is representative of production aircraft, with Dart 511 engines, and seats 32 in a 23.1 m. (76 ft.) fuselage. Two further prototype airframes were built for structure testing.

Quantity production of the Friendship by both Fokker in the Netherlands and Fairchild in America has started, and the first Fokker-built aircraft for Aer Lingus is scheduled for delivery during 1958.

The production Friendship is a high-wing cantilever monoplane with standard seating for 32 passengers in a pressurised cabin. Backward-facing seats are optional. For short range high-density traffic the number of seats may be increased to 36 or 40. The low floor level, large cargo holds and a removable front cabin wall make the Friendship well suited to those local services with many intermediate stops, where quick and simple loading and adaptation to ever-changing load demands are of importance.

The Friendship is powered initially by two 1,720 e.h.p. Rolls-Royce Dart RDa.6 Mk. 511 engines, but the more powerful RDa.7 Dart will be introduced on Stage 2 Friendships at a future date, not yet decided.

In addition to the standard airliner version, there is an executive and V.I.P. transport version of the Friendship, of which several have already been ordered. There are also projected cargo and military transport versions, known as the Freightship and Troopship respectively.

At the time of writing the following orders for Fokker and Fairchild-built Friendships had been reported: Aer Lingus (7), Aerolineas Argentinas (10), Aerovias Ecuatorianas (1), Aerovias Venezolanas (5), Bank of Mexico (1), Bonanza Airlines (3), Braathens (3), Butler Air Transport (5), Continental Can Co (1), Department of Civil Aviation Australia (1), General Tire and Rubber Co. (1) Iranian Oil Co. (2), K.L.M. (2), Mackey Airlines (2), Netherlands Government (1), Northern Consolidated Airlines (3), Piedmont Airlines (12), Quebecair (2), R-I-V-Turin (1), Southwest Airways (3), Trabajos Aereos Enlaces, Spain (3), Trans-Australia Airlines (6), Tropical Investors (1), West Coast Airlines (6), Wheeler Airlines (2) and Wien Alaska Airlines (3). Negotiations with other airlines are proceeding.

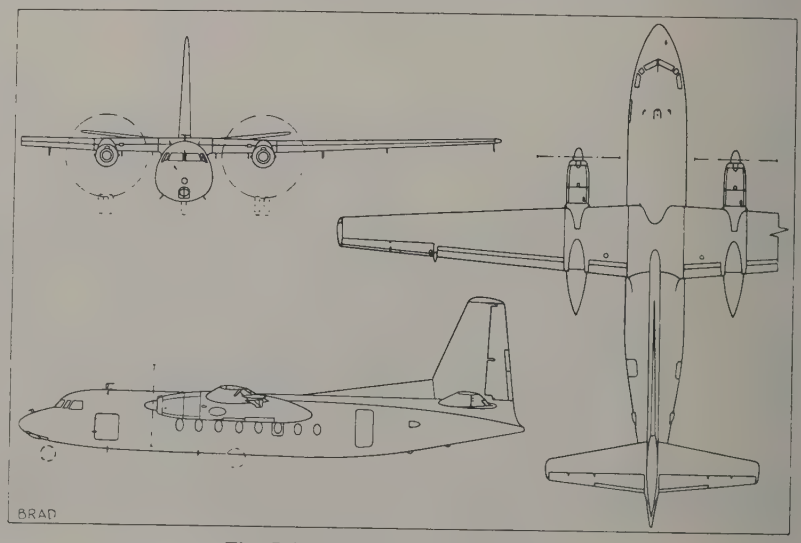
TYPE.—Twin turboprop-engined 32/40 passenger Airliner.

WINGS.—High-wing cantilever monoplane. Wing section NACA 64-421 at root, 64-415 at tip. Aspect ratio 12. Taper ratio 0.4. Chord 3.45 m. (11 ft. 5 in.) at root, 1.4 m. (4 ft. 7 in.) at tip. All-metal riveted and metal-bonded two-spar stressed-skin structure consisting of centre-section and two detachable outer sections. Reinforced fibreglass leading and trailing edges, tips and fillets. Rubber-boot de-icers (thermal anti-icing through electric heat exchanger optional). Electrically-operated single-slotted flaps between ailerons and fuselage but divided by engine nacelles. Slotted ailerons. Gross wing area 70 m.² (754 sq. ft.).

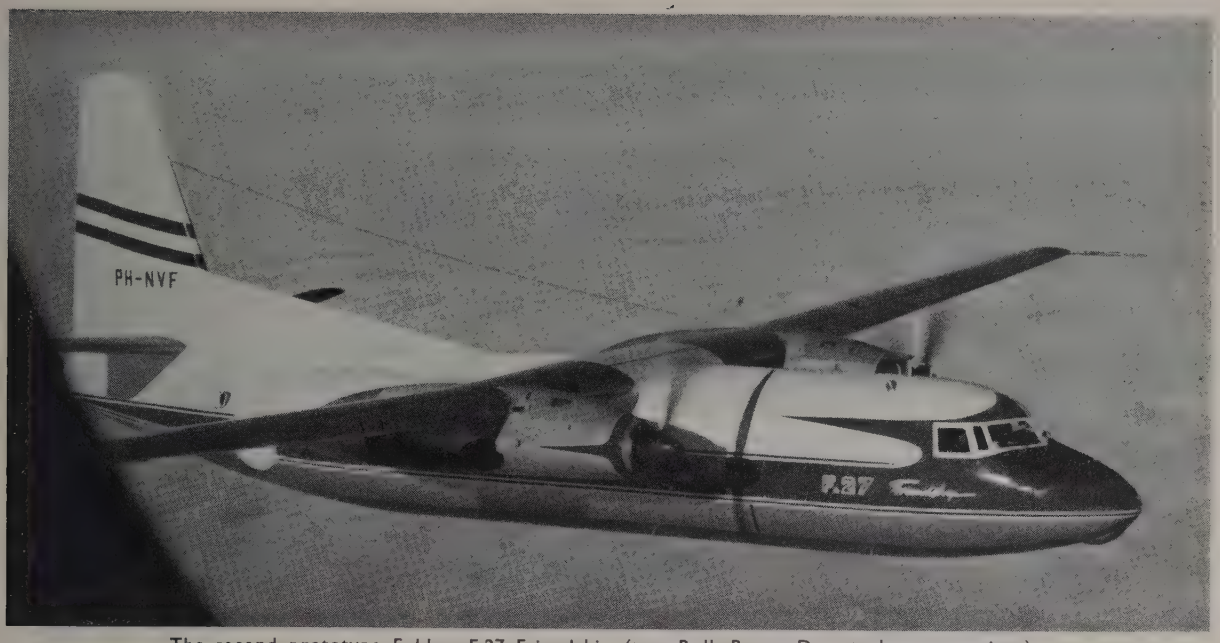
FUSELAGE.—All-metal stressed-skin structure with cylindrical portions metal bonded and conical parts riveted. Between rear bulkhead of nose-wheel compartment and the circular pressure bulkhead aft of the luggage compartment the fuselage is pressurised to a differential of 4.16 lb./sq. in. (0.29 kg./cm.²). Length of pressurised section 16.16 m. (53 ft.). Diameter of fuselage 2.7 m. (8 ft. 10 in.). The slightly flattened fuselage bottom is reinforced by special under-floor members.

TAIL UNIT.—Cantilever monoplane type. All-metal stressed-skin structure. Fin and tailplane, as well as leading-edges of surfaces, are detachable. Rubber-boot de-icing (thermal anti-icing optional). Total area of vertical surfaces 14.2 m.² (150 sq. ft.), of horizontal surfaces 16.0 m.² (172 sq. ft.). Span of tail 9.8 m. (32 ft.).

LANDING GEAR.—Retractable tricycle type. Pneumatic retraction. Dowty oleo-pneumatic shock-absorber struts. All units of



The Fokker F.27 Friendship Airliner.



The second prototype Fokker F.27 Friendship (two Rolls-Royce Dart turboprop engines).

twin-wheel type. Main units retract backward into engine nacelles, nose unit forward into non-pressurised reinforced fibre-glass nose cone. Pneumatic brakes on main wheels, which also have Dunlop Maxaret automatic anti-skid system. Wheelbase 8.48 m. (27 ft. 10 in.). Track of main units (between centre-lines of shock-absorbers) 7.20 m. (23 ft. 7½ in.).

Power Plant (Stage 1).—Two Rolls-Royce Dart Mk. 511 (RDa.6 rating) turboprop engines, each developing 1,600 s.h.p. plus 168 kg. (370 lb.) s.t. for take-off and a maximum continuous power of 1,460 s.h.p. plus 155 kg. (340 lb.) s.t. at 14,200 r.p.m. at sea level. Four-blade Rotol airscrews 3.66 m. (12 ft.) diameter. Integral fuel tanks in outer wings. Total fuel capacity 3,700 litres (814 Imp. gallons). Overwing fueling, but underwing system can be installed on request. Methylbromide fire-prevention system with flame detectors and crash-inertia switches.

Power Plant (Stage 2).—Two Rolls-Royce Dart Mk. 520 (RDa.7 rating) turboprop engines, each developing 1,700 s.h.p. plus 225 kg. (495 lb.) s.t. for take-off and a maximum continuous power of 1,555 s.h.p. plus 195 kg. (430 lb.) s.t. at 14,400 r.p.m. at sea level. Four-blade airscrews 3.50 m. (11 ft. 6 in.) diameter. These engines can be embodied in basic airframe without major structural alterations.

Accommodation (airliner).—Flight compartment seats two side-by-side. Main cabin has standard capacity for 32 passengers, but alternative arrangements allow this number to be increased to 36 by moving front cabin bulkhead. A further 4 seats can be added by moving rear cabin bulkhead and transferring pantry to forward cargo compartment. Pressurisation at 4.16 lb./sq. in. allows a cabin altitude of 2,440 m. (8,000 ft.) to be maintained up to a height of 6,100 m. (20,000 ft.). Air-conditioning and heating. Volume of forward cargo compartment 7.25 m.³ (255 cub. ft.) in standard 32-passenger version, and 5 m.³ (177 cub. ft.) in 36-passenger version. Volume of rear baggage compartment 2.8 m.³ (100 cub. ft.) and 1.85 m.³ (66 cub. ft.) respectively. Entrance door, toilet, pantry and stewardess' seat aft of cabin, except in 36 and 40-passenger versions, where the pantry is located in forward cargo compartment.

Accommodation (executive and V.I.P. version).—Can be furnished to customer's specification, but a basic layout is available. In this, the cabin is divided into three sections : a conference room with six seats, a rest room with settee and divan, and a lounge with four seats. Toilet, galley, wardrobe, luggage space and seat for attendant in forward fuselage. Second toilet and luggage space at rear.

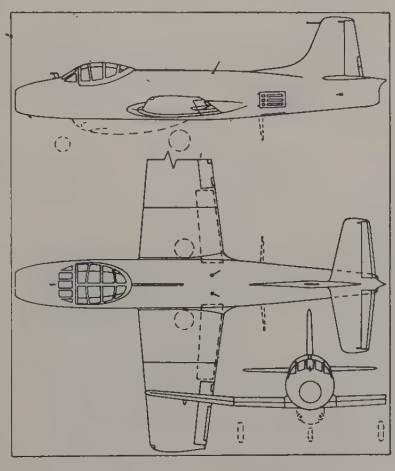
Equipment.—Pneumatic system for landing-gear retraction and brakes, with separate emergency system. Two separate electrical systems to provide power for flaps, anti-icing, radio, etc. Standard radio equipment includes VHF and HF receiver/transmitters, automatic D/F radio-compass, ILS and intercommunications system. 38.4 cub. ft. oxygen system available for pilots.

Dimensions.—
Span 29.0 m. (95 ft.).
Length 23.1 m. (76 ft.).
Height 8.4 m. (27 ft. 6 in.).

Weights (32 passengers, Dart 511 engines).—
Weight empty 9,659 kg. (21,295 lb.).
Crew (3) 215 kg. (473 lb.).
Equipment 100 kg. (221 lb.).
Max. disposable load (fuel and oil plus payload) 5,670 kg. (12,520 lb.).
Max. permissible take-off weight 15,600 kg. (34,520 lb.).
Max. landing weight 15,422 kg. (34,000 lb.).
Max. zero-fuel weight 14,606 kg. (32,200 lb.).
Wing loading 224 kg./m.² (45.8 lb./sq. ft.).
Power loading 4.5 kg./h.p. (9.9 lb./h.p.).

Weights (32 passengers, Dart 520 engines).—
Weight empty 9,656 kg. (21,290 lb.).
Max. permissible take-off weight 16,112 kg. (35,520 lb.).
Max. landing weight 15,420 kg. (34,000 lb.).
Max. zero-fuel weight 14,610 kg. (32,210 lb.).

Performance (Dart 511 engines, at 14,970 kg. = 33,000 lb. A.U.W.).—
Max. speed at 6,100 m. (20,000 ft.) with 13,800 r.p.m. 450 km.h. (280 m.p.h.).
Cruising speed at 6,100 m. (20,000 ft.) with 13,600 r.p.m. 442 km.h. (275 m.p.h.).
Rate of climb at S/L. with 13,800 r.p.m. 452 m./min. (1,480 ft./min.).
Rate of climb on one engine 157 m./min. (515 ft./min.).
Service ceiling on one engine 4,800 m. (15,700 ft.).



The Fokker S.14 Mach-Trainer.

Range in still air with max. fuel and 2,767 kg. (6,100 lb.) payload at 6,100 m. (20,000 ft.), no allowances, 2,205 km. (1,370 miles).
Range in still air with max. payload, no reserves, 725 km. (450 miles).
Take-off distance 750 m. (2,450 ft.).
C.A.R. 4b take-off field length 1,323 m. (4,340 ft.).
C.A.R. 4b landing field length 915 m. (3,000 ft.).

Performance (Dart 520 engines, estimated).—
Cruising speed at 6,100 m. (20,000 ft.) at 14,970 kg. (33,000 lb.) A.U.W. 504 km.h. (313 m.p.h.).
Time to 6,100 m. (20,000 ft.) 18 min.
Service ceiling, one engine out, 5,335 m. (17,500 ft.).
C.A.R. take-off field length, ISA conditions, at max. A.U.W. 1,265 m. (4,150 ft.).
C.A.R. take-off field length, ISA + 15°C., at max. A.U.W. 1,370 m. (4,500 ft.).
C.A.R. landing field length 915 m. (3,000 ft.).

THE FOKKER S.14 MACH-TRAINER.

Type.—Two-seat Jet trainer for transition, blind-flying, navigational and tactical training of fighter pilots.

Wings.—Low-wing cantilever monoplane. All-metal monospar structure with flush-riveted stressed Alclad skin. Ailerons on outer sections with spring tabs. Pneumatically-operated split trailing-edge flaps between ailerons and fuselage. Wing area 31.8 m.² (342.1 sq. ft.).

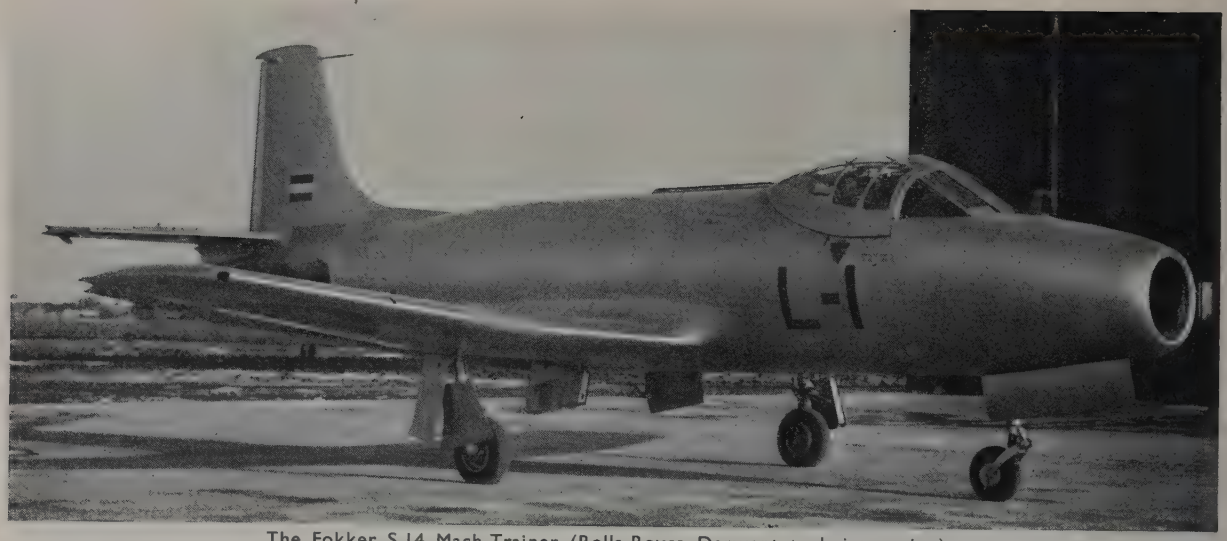
Fuselage.—Circular section structure mainly of light metal construction, the engine compartment being of steel. Pneumatically-operated dive-brakes open out from sides and underside of fuselage aft of wings.

Tail Unit.—Cantilever monoplane type. All-metal construction. Fin integral with rear fuselage. Statically-balanced light elevators. Statically-balanced geared tabs in both elevators, trim tab in port elevator. Tailplane span 5.00 m. (16 ft. 6.4 in.).

Landing Gear.—Retractable tricycle type. Pneumatic retraction. Main and nose wheel units of levered-suspension type with Dowty liquid-spring shock-absorbers. Pneumatically-operated disc brakes on main wheels. Self-centering nose-wheel. Track 4.95 m. (16 ft. 3 in.). Wheelbase 4.00 m. (13 ft. 3 in.).

Power Plant.—One Rolls-Royce Derwent 8 or Nene 3 centrifugal-flow turbojet engine in centre-section of fuselage with nose air entry, dividing to pass on each side of cockpit, and tail jet exit. Six flexible light-weight hycatrol fuel tanks in wings, two in centre-section and two in each outer section. Total fuel capacity 1,700 litres (375 Imp. gallons).

Accommodation.—Enclosed cockpit seating instructor and pupil side-by-side with dual controls. Electrically-operated sliding and jettisonable canopy. Cockpit separated from engine compartment by steel fire-proof bulkhead.



The Fokker S.14 Mach-Trainer (Rolls-Royce Derwent turbojet engine).

EQUIPMENT.—Complete blind-flying and navigational training equipment. Provision for armament-pack installation beneath fuselage of two 20 mm. cannon and ammunition. Camera-gun. Racks for eight 3 in. rockets or eight 25-lb. practice bombs.

DIMENSIONS.—
Span 12 m. (39 ft. 5 in.).
Length 13.3 m. (43 ft. 8 in.).
Height 4.7 m. (15 ft. 4 in.).

WEIGHTS AND LOADING (Rolls-Royce Derwent 8 engine).—
Weight empty 3,765 kg. (8,304 lb.).
Crew (2) and parachutes 214 kg. (472 lb.).
Fuel and oil 1,371 kg. (3,024 lb.).
Take-off weight 5,350 kg. (11,800 lb.).
Wing loading 168 kg./m.² (34.5 lb./sq. ft.).

WEIGHTS AND LOADING (Rolls-Royce Nene 3 engine).—
Weight empty 3,970 kg. (8,745 lb.).
Crew (2) and parachutes 214 kg. (472 lb.).
Fuel and oil 1,366 kg. (3,013 lb.).
Weight loaded 5,550 kg. (12,230 lb.).
Wing loading 174.5 kg./m.² (36 lb./sq. ft.).

PERFORMANCE (Rolls-Royce Derwent 8 engine).—
Max. speed at 6,000 m. (19,680 ft.) at combat rating 730 km.h. (455 m.p.h.).
Mean cruising speed at 9,000 m. (29,520 ft.) 570 km.h. (355 m.p.h.).
Min. speed at S/L. (flaps 45°) 142 km.h. (88 m.p.h.).
Max. rate of climb at S/L. 945 m./min. (3,100 ft./min.).
Climb to 3,000 m. (9,840 ft.) 3.5 min.
Climb to 6,000 m. (19,680 ft.) 8.5 min.
Climb to 9,000 m. (29,520 ft.) 19.4 min.
Service ceiling 11,200 m. (36,700 ft.).
Take-off distance to 15 m. (50 ft.) 900 m. (2,950 ft.).
Endurance at 400 km.h. (249 m.p.h.) at 9,000 m. (29,520 ft.) 1.45 hours.
Endurance at 480 km.h. (298 m.p.h.) at 9.000 m. (29,520 ft.) 1.70 hours.
Range at 570 km.h. (355 m.p.h.) at 9,000 m. (29,520 ft.) including climb to altitude 965 km. (600 miles).

PERFORMANCE (Rolls-Royce Nene 3 engine).—
Max. speed at 3,000 m. (9,820 ft.) at combat rating 861 km.h. (536 m.p.h.).
Mean cruising speed at 9,000 m. (19,680 ft.) 781 km.h. (484 m.p.h.).
Min speed at S/L. (flaps 45°) 145 km.h (90 m.p.h.).
Max. rate of climb at S/L. 1,660 m./min. (5,450 ft./min.).
Climb to 3,000 m. (9,840 ft.) 2.1 min.
Climb to 6,000 m. (19,680 ft.) 4.8 min.
Climb to 9,000 m. (29,520 ft.) 8.8 min.
Climb to 10.500 m. (34,440 ft.) 11.8 min.
Service ceiling 12,900 m. (42,310 ft.).
Take-off distance to 15 m. (50 ft.) 730 m. (2,395 ft.).
Endurance at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.) 1.50 hours.
Endurance at 480 km.h. (298 m.p.h.) at 9,000 m. (29,520 ft.) 1.70 hours.
Range at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.) including climb to altitude 910 km. (565 miles).

HOLLANDAIR

HOLLANDAIR T.B.

HEAD OFFICE AND WORKS: 67A TRAMSTRAAT, KATWIJK/A/ZEE.
Managing Director: J. K. Hoekstra.
Designer: J. Velberg.
Works Manager: G. den Bezemer.

Hollandair was formed originally as an aeronautical trading company and began the overhaul of aircraft and engines early in 1956. In December of that year, work was started on the design of the H.A.-001 agricultural aircraft, of which a prototype is under construction. This aircraft made its first flight in the summer of 1957.

THE HOLLANDAIR H.A.-001.

TYPE.—General-purpose Agricultural aircraft.

WINGS.—Braced high-wing monoplane NACA 23012 wing section. Aspect ratio 7.5. Constant chord 2.0 m. (6 ft. 7 in.). Dihedral 1° 30′. Incidence 6°. All-wood construction. Leading-edge plywood-covered: rest fabric-covered. All-wood ailerons. No flaps. Aileron area 3.5 m.² (37.67 sq. ft.). Gross wing area 30 m.² (323 sq. ft.).

FUSELAGE.—Welded steel-tube structure, fabric-covered.

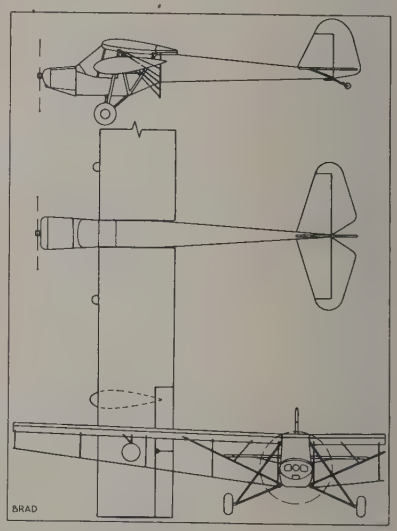
TAIL UNIT.—Wood construction. Areas: fin 0.8 m.² (8.61 sq. ft.), rudder 1.0 m.² (10.76 sq. ft.), tailplane 1.80 m.² (19.38 sq. ft.), elevators 2.70 m.² (29.06 sq. ft.). Tailplane span 4.0 m. (13 ft. 1½ in.).

LANDING GEAR.—Non-retractable tail-wheel type. Hollandair rubber-in-compression shock-absorbers. Goodyear Aero-4 wheels, 8.50 × 6. Goodyear brakes. Wheel track 3.5 m. (11 ft. 6 in.).

POWER PLANT.—One 135 h.p. Lycoming O-290-02 four-cylinder horizontally-opposed air-cooled engine driving a Sensenich M74DM two-blade airscrew. Provision for installing as alternative one 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Fuel in two tanks in wing centre-section, adjacent to fuselage, with total capacity of 100 litres (22 Imp. gallons).

ACCOMMODATION.—Pilot's cabin is without doors to facilitate escape in an emergency.

EQUIPMENT.—Normally fitted with spray tanks under wings, with total capacity of 300 litres (66 Imp. gallons). Provision for hopper or dust container in fuselage. Can be equipped for towing sailplanes and advertising banners.



The Hollandair H.A.-001.



The Hollandair H.A.-001 Agricultural Monoplane (135 h.p. Lycoming engine).

DIMENSIONS.—
Span 15 m. (49 ft. 2½ in.).
Length 8.40 m. (27 ft. 6½ in.).
Height 1.80 m. (5 ft. 11 in.).

WEIGHTS (estimated).—
Weight empty, with spray tanks 500 kg. (1,100 lb.).
Weight loaded 950-1,000 kg. (2,095-2,200 lb.).

PERFORMANCE (estimated).—
Economical cruising speed 105 km.h. (65 m.p.h.).
Spraying speed 90 km.h. (56 m.p.h.).
Stalling speed 61.5 km.h. (38 m.p.h.).
Rate of climb at S/L. 240 m./min. (790 ft./min.).
Take-off run under 100 m. (330 ft.).
Landing run under 100 m. (330 ft.).

NHI

NEDERLANDSE HELICOPTER INDUSTRIE N.V.

HEAD OFFICE AND WORKS: VLIEGVELD ZESTIENHOVEN, ROTTERDAM, W2.

This company is continuing the helicopter development work started by the SOBEH helicopter foundation, which was formed to design and build an experimental rotary-wing aircraft using a rotor system driven by ram-jets. The prototype SOBEH H-2, now known as the NHI H-2, first flew in May, 1955 and the first production H-3 followed in May, 1956. Four are being sent to Dutch New Guinea. The following details apply to the H-3 :—

THE NHI H-3 KOLIBRIE.

TYPE.—Light ramjet-powered helicopter.

ROTOR SYSTEM.—Two-bladed "see-saw" main rotor, with blades of bonded metal construction. Packet of leaf springs attaches each blade to hub. Area of each rotor blade 1.093 m.² (11.76 sq. ft.). Total main disc area 79.2 m.² (852.2 sq. ft.). Single-bladed tail rotor, the blade being of laminated wood construction.

ROTOR DRIVE.—Main rotor by ramjet engines at blade tips, anti-torque rotor by gear-box and shaft from main rotor. Anti-torque/main rotor r.p.m. ratio 6¾.

FUSELAGE.—Duralumin 24 ST box structure.

LANDING GEAR.—Metal skids with two ground-handling wheels. No shock-absorbers. Skid track 1.90 m. (6 ft. 2¾ in.). Alternatively, pontoons for amphibious operation.

POWER PLANT.—Two 55 h.p. NHI TJ-5 ramjets, burning kerosene fuel, each attached to rotor blade tips by two bolts. Four cylindrical fuel tanks mounted below body on landing-gear cross struts. Total fuel capacity 440 litres (97 Imp. gallons).



The NHI H-3 Kolibrie Ramjet-powered Helicopter.

ACCOMMODATION. — Normally two seats. Alternatively, with one seat H-3 can be adapted to carry two stretchers, or crop-spraying or seed-sowing equipment, or load-carrying hook, or can be fitted with pontoons for over-water flying.

DIMENSIONS.—
- Main rotor diameter, over jets, 10.06 m. (33 ft.).
- Anti-torque rotor diameter 0.92 m. (3 ft.).
- Length of fuselage 4.0 m. (13 ft. 1 in.).
- Height to top of rotor pylon 2.55 m. (8 ft. 4 in.).
- Width of fuselage 2.0 m. (6 ft. 6½ in.).

WEIGHTS.—
- Weight empty 220 kg. (484 lb.).
- Weight loaded 650 kg. (1,430 lb.).

PERFORMANCE.—
- Cruising speed 100 km.h. (62 m.p.h.).
- Cruising speed for max. endurance 60 km.h. (37 m.p.h.).
- Endurance approx. 1 hour.

THE PHILIPPINE REPUBLIC

INSTITUTE OF SCIENCE AND TECHNOLOGY. (FORMERLY BUREAU OF SCIENCE).

Herran Street, Manila, P.I.

Director: Dr. Joaquin Marañon.

Chief, Aircraft Research and Development Unit: Eng. Antonio J. de Leon.

The Institute of Science and Technology, Manila, is conducting a programme of research and study to investigate the possibilities of aircraft construction in the Philippines. This work is being undertaken under the direction of Engineer Antonio J. de Leon.

As part of this programme the Institute designed, built and flew the XL-14 Maya experimental monoplane. The main object in building the XL-14 was to test the application of locally available materials, such as home-grown woods, plywood, bamboo, etc., to aircraft construction. One experimental material under test is "Wobex" (Woven Bamboo Experimental) which is a form of reinforced woven bamboo. Work on the XL-14 has been suspended.

A second aircraft, the XL-15 Tagak Ambulance, which has been developed as a joint project of the Institute of Science and Technology and the Philippine Air Force, has been undergoing flight evaluation tests since October, 1954, and a higher-powered floatplane version of this aircraft is in the preliminary design stage. The structure of the XL-15 is entirely of local woods, plywood, "Wobex" and allied materials.

The prototype of a new light two-seat touring and training monoplane, the XL-17 Musang, was completed in October, 1956 and is now being flight tested.

THE XL-17 MUSANG.

Type.—Two-seat light Touring and Training monoplane.

Wings.—Low-wing cantilever monoplane. Wing section U.S.-35B at root, NACA 23012 at tip. Aspect ratio 6.85. Chord 1.70 m. (5 ft. 6½ in.) at root, 1.10 m. (3 ft. 7 in.) at tip. Dihedral 5°. Incidence 2°. One-piece all wooden structure with plywood covering. Slotted ailerons. Split flaps. Total area of ailerons 1.60 m.² (17.22 sq. ft.). Total area of flaps 0.90 m.² (9.69 sq. ft.). Gross wing area 13.40 m.² (144.2 sq. ft.).

Fuselage.—Semi-monocoque with wooden bulkheads and stringers. Plywood covering.

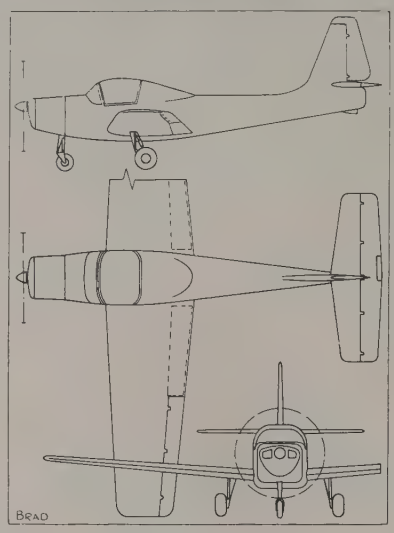
Tail Unit.—All-wood cantilever monoplane type, with plywood covering. Areas: fin 0.74 m.² (7.97 sq. ft.), rudder 0.65 m.² (7.0 sq. ft.), elevators 1.25 m.² (13.45 sq. ft.), tailplane 1.67 m.² (17.97 sq. ft.). Tailplane span 3.40 m. (11 ft. 2 in.).

Landing Gear.—Fixed tricycle type. Oleo-pneumatic shock absorbers. Main wheel tyres low-pressure 8.00×4. Nose-wheel tyre 5.00×5. Hydraulic brakes. Wheel track 2.40 m. (7 ft. 10 in.).

Power Plant.—One Lycoming O-235-C1 four-cylinder horizontally-opposed air-cooled engine, rated at 108 h.p. and with 115 h.p. available for take-off. Two-blade fixed-pitch wooden airscrew. One 18 U.S. gallon (68 litre) fuel tank in fuselage behind seats. Oil capacity 1½ U.S. gallons (5.7 litres).



The XL-17 Musang (115 h.p. Lycoming O-235 engine).



The XL-17 Musang.

Accommodation.—Enclosed cabin with two side-by-side seats. Provision for seat or back type parachutes.

Dimensions.—
Span 9.60 m. (31 ft. 6 in.).
Length 7.20 m. (23 ft. 7 in.).
Height 3.20 m. (10 ft. 6 in.).

Weights.—
Weight empty 510 kg. (1,124 lb.).
Weight loaded 735 kg. (1,620 lb.).

Performance.—
Max. speed 203 km.h. (126 m.p.h.).
Cruising speed 161 km.h. (100 m.p.h.).
Landing speed (flaps down) 80 km.h. (50 m.p.h.).
Rate of climb at S/L. 230 m./min. (755 ft./min.).



The XL-15 Tagak (185 h.p. Lycoming O-425 engine).

THE XL-15 TAGAK.

The XL-15 Tagak has been under development since October, 1954. It was slightly modified in 1955-56 to provide increased rudder area and a shimmy damper in the landing gear nose-wheel.

A higher-powered floatplane version is in the initial design stage.

Type.—Single-engined General Utility, Liaison or Ambulance aircraft.

Wings.—High-wing semi-cantilever monoplane. Aerofoil sections Mod. NACA 23012 (centre section), USA 35B (outer wings). Aspect ratio 7.1. Dihedral 3°. Incidence at root 2°. Aerodynamic twist —3°. Chord 1.80 m. (5 ft. 11 in.) at root, 1.10 m. (3 ft. 7 in.) at tip. Single lift struts modified to provide additional lift. Split type flaps and slotted ailerons. Total area of flaps 1.46 m.² (15.70 sq. ft.). Total aileron area 1.73 m.² (18.60 sq. ft.). Gross wing area 20.30 m.² (218.43 sq. ft.). Additional area provided by lift struts 0.94 m.² (10.10 sq. ft.).

Fuselage.—Semi-monocoque structure of reinforced wood and plywood and covered with Wobex and plywood. Twin tail booms of all-plywood construction are integral with centre-section.

Tail Unit.—Rectangular tailplane between booms, fins integral with booms. One-piece horn-balanced elevators and two rudders. Tailplane and fins of composite wood and plywood construction with Wobex covering. Elevator and rudders are fabric-covered. Trim-tab in elevator. Areas: fins (2) 1.32 m.² (14.21 sq. ft.), rudders (2) 1.20 m.² (12.92 sq. ft.), tailplane 1.86 m.² (19.70 sq. ft.), elevator (including tab) 1.26 m.² (11.70 sq. ft.).

Landing Gear.—Fixed nose-wheel type. Oleo-spring shock struts for main wheels, oleo-pneumatic strut for nose-wheel. Hydraulic wheel-brakes on main wheels.

Power Plant.—One 185 h.p. Lycoming O-425A six-cylinder horizontally-opposed air-cooled engine. Fixed-pitch two-blade airscrew. Fuel capacity 174 litres (46 U.S. gallons).

Accommodation.—Enclosed cabin seating four in two pairs. For ambulance duties one or two (one above the other) stretcher cases, plus medical attendant, may be carried. Cabin dimensions length 3.26 m. (10 ft. 6 in.), width 0.96 m. (3 ft. 1½ in.).

Dimensions.—
Span 12.00 m. (39 ft. 5 in.).
Length 9.15 m. (30 ft. 0 in.).
Height 2.80 m. (9 ft. 3 in.).

Weights and Loadings.—
Weight empty 780 kg. (1,716 lb.).
Disposable load 470 kg. (1,034 lb.).
Weight loaded 1,250 kg. (2,750 lb.).
Wing loading 61.5 kg./m.² (12.6 lb./sq. ft.).
Power loading 6.58 kg./h.p. (14.51 lb./h.p.).

Performance.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 158 km.h. (98 m.p.h.).
Landing speed (without flaps) 97 km.h. (60 m.p.h.).
Landing speed (with flaps) 76 km.h. (47 m.p.h.).
Initial rate of climb 180 m./min. (590 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Take-off distance to 20 m. (65 ft.) with flaps 360 m. (393 yds.).
Range 675 km. (420 miles).

POLAND

Following the signing of the Warsaw Treaty, the Polish aircraft industry, in common with the aircraft industries of the other signatories, was completely re-organised under Russian direction. Its factories were modernised and expanded, and various types of Russian-designed aircraft were put into production.

Simultaneously, almost all aircraft of national design were abandoned and the design offices of L.W.D. (Lotnicze Warsztaty Doswiadczaine) and C.S.S. (Centralne Studium Samolotow), which were responsible for several successful aircraft in the years immediately after the war, were dissolved. Aircraft production centres, formerly incorporated in P.Z.L. (Panstwowe Zaklady Lotnicze—State Aircraft Factories), were renamed as W.S.K. —Wytwornie Sprzetu Komunikacyjnego (Transport Equipment Manufacturing Centres), to conceal the nature of their work.

The I.L. (Aircraft Institute) was allotted tasks of scientific research into specific problems of aircraft engineering. But in 1952 a small design office was established there under the leadership of T. Soltyk, former chief designer of L.W.D. This office resumed work on the nationally-designed projects, although such activities were officially discouraged and severely limited.

After the political changes of October, 1956, a second reorganisation of the Polish aircraft industry began and it is now engaged on a carefully-planned programme to develop aircraft of its own design. The plan provides for construction of two types of basic trainer, one of them jet-powered, one aerobatic aircraft, one glider-tug and general purpose aircraft, one passenger transport aircraft and three types of helicopters. In addition, development of a 180 h.p. piston engine, a light jet engine and a turboprop engine, and of servicing and maintenance equipment for aircraft is also planned. The I.L. will return to its original tasks of scientific research, and design offices are being established at various aircraft factories. The W.S.K. at Swidnik, near Lublin, has been renamed the Polskie Zaklady Lotnicze (P.Z.L.), so reviving the old and famous pre-war name.

Meanwhile, the production of certain types of Russian-designed aircraft continues. Single-seat jet fighters of MiG design have been in production in Poland since 1950. Initially, they were of the MiG-15*bis* type, first deliveries of which were made to the Polish Air Force early in 1953 from the W.S.K. factory at Mielec. A version with more powerful engine followed, and several hundred MiG-15's were built before being superseded on the assembly lines by MiG-17's.

When production of military aircraft in Poland was reduced drastically, some factories were threatened with closure or a transfer to non-aviation work. To prevent this so far as possible, licences have been obtained from Russia for construction in Poland of the Yak-12M light general purpose monoplane and the Mi-1 helicopter, which is being built at the P.Z.L. factory at Swidnik under the designation SM-1. Both of these types, together with powered aircraft and gliders of Polish design, are offered for export.



The Polish-built Yak-12M Light General Purpose Monoplane.

The sales of all Polish aviation products, as well as the information service, are handled exclusively by a state-controlled enterprise:—Motoimport, 26 Przemystowa, Warsaw.

THE LWD JUNAK (CADET).

Designed by Dipl. Ing. T. Soltyk, who at that time, was chief designer of L.W.D., to meet the requirements of Polish flying schools, the Junak first appeared early in 1948. It was the only nationally-designed aircraft on which work was not abandoned in 1950-53 and the only post-war Polish aeroplane to be put in large-scale production until recently. The following versions have been built.

Junak 1. Prototype with Russian 125 h.p. M-11G engine. Tail-wheel type landing gear. First flew February 22, 1948.

Junak 2. Initial production version with Polish-built 160 h.p. M-11FR engine. Tail-wheel type landing-gear.

Junak 3. Similar to Junak 2, but with tricycle landing gear and comprehensive radio. Designed at the I.L. (Aircraft Institute) to meet demands for an interim transition trainer for military jet pilots until the more advanced Bies is available. Prototype flew on August 7, 1953 and two versions, Mk. 3A and Mk. 3B, have been built in quantity, differing in fuel tank installations. Still in production.

In addition, the Zuch 1 with Walter Minor 6-III six-cylinder in-line engine and Zuch 2 with a German-designed Bramo Sh-14 seven-cylinder radial engine were derived from the Junak 1, and the Zuch 2 was in limited production in 1949-50.

The Junak 1 and Zuch 1 have been described in earlier editions of "All the World's Aircraft." The following details apply specifically to the Junak 3.

TYPE.—Two-seat Basic trainer.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23012 at root, NACA 23009 at tip. In three portions. Centre-section is two-spar structure of welded chrome-molybdenum steel-tube with covering of plywood and fabric, and is integral with fuselage. Outer wings of two-spar wooden construction, with plywood covering back to rear spar and fabric covering aft of rear spar. Frise type ailerons of wooden construction. Manually-operated metal flaps. Wing area 17.5 m.² (188.4 sq. ft.).

FUSELAGE. — Welded chrome - molybdenum steel-tube structure with wooden fairings. Metal covered forward of cockpits : fabric covering aft.

TAIL UNIT.—Cantilever monoplane type. Tailplane, fin and rudder have wooden structure covered with plywood and fabric. Elevators have metal structure covered with plywood and fabric. Trim-tabs in elevators.

LANDING GEAR.—Non-retractable tricycle type. Main wheels on cantilever oleo-pneumatic shock-struts. Hydraulic brakes operated independently from each cockpit. Low-pressure tyres. Castoring nose-wheel on braced oleo-pneumatic strut with centre-lock and anti-shimmy damper. Wheel track 2.27 m. (7 ft. 5½ in.). Wheelbase 1.825 m. (6 ft.).

POWER PLANT.—One Polish-built M-11FR five-cylinder air-cooled radial engine rated at 140 h.p. at 1,760 r.p.m. and with a maximum power of 160 h.p. at 1,900 r.p.m. Enclosed in helmeted cowling and driving a Type J-6 two-blade fixed-pitch airscrew. Main fuel tank in port centre-section, between spars. Supplementary fuel tank behind fuselage firewall in Mk. 3A, in nose of port centre-section on Mk. 3B. Total fuel capacity approximately 100 litres (22 Imp. gallons).

ACCOMMODATION.—Tandem seats under transparent canopies, with pupil at rear. Dual controls and instruments, including blind-flying instruments. Canopy over forward cockpit hinges sideways and is jettisonable. Canopy over rear cockpit slides rearward. Baggage compartment behind rear seat. Radio and radio-compass.

DIMENSIONS.—
Span 10 m. (32 ft. 10 in.).
Length 7.75 m. (25 ft. 5 in.).
Height 2.5 m. (8 ft. 2¾ in.).

WEIGHTS AND LOADINGS.—
Weight empty 818 kg. (1,803 lb.).
Weight loaded 1,080 kg. (2,381 lb.).
Wing loading 62 kg./m.² (12.69 lb./sq. ft.).
Power loading 6.75 kg./h.p. (14.87 lb./h.p.).

PERFORMANCE.—
Max. speed 205 km.h. (127 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Max. permissible speed 380 km.h. (236 m.p.h.).
Min. speed, flaps up, 100 km.h. (62 m.p.h.).
Rate of climb at S/L 210 m./min. (690 ft./min.).
Ceiling 4,100 m. (13,450 ft.).
Range 450 km. (280 miles).
Endurance 2½ hr.



The LWD Junak Mk. 3B (160 h.p. Polish-built M-11FR engine).

THE LWD ZURAW (CRANE).

The Zuraw was the last design produced by the Lotnicze Warsztaty Doswiadczaine (LWD), or Aircraft Experimental Workshops, at Lódz, before they were closed. It was intended originally as a liaison aircraft for the Polish Air Force, with secondary applications for air ambulance, photo-reconnaissance, glider-towing and mail-carrying duties. To fulfil these

tasks, the designers concentrated on providing short landing and take-off characteristics, for operation from unprepared strips.

The prototype of the Zuraw made its first flight on May 16, 1951, bearing military markings. Later, it was given the civil registration of SP-GLB. As its performance was not considered satisfactory with a 160 h.p. M-11-FR engine, an improved version known as the Zuraw II is under construction with a 300 h.p. engine of Polish design.

TYPE.—Two/three-seat General purpose monoplane.

WINGS.—High-wing braced monoplane. NACA 23012 wing section. Aspect ratio 6.52. Sweep-forward 1.8°. All-wood two-spar structure with plywood covering on forward portion of wings and fabric covering aft. Two parallel streamlined steel-tube bracing struts on each side. For transport wings can be folded and stowed above fuselage, by unlocking the front spar fittings and turning the wings 90° horizontally towards the tail, about the axis of the rear spar fittings and bottom hinges of the rear bracing struts. When fully-folded the wings overlap each other. Wooden split type ailerons with fabric covering. Wooden manually-operated flaps with fabric covering have maximum deflection of 40° for take-off. Manually-operated wooden leading-edge slats with light alloy covering. Landing light under port wing. Total area of ailerons 1.87 m.² (20.1 sq. ft.). Total area of flaps 3.89 m.² (41.8 sq. ft.). Total area of slats 2.08 m.² (22.38 sq. ft.). Gross wing area 21 m.² (225.96 sq. ft.).

FUSELAGE.—Steel-tube structure with light wooden top-fairing and fabric covering overall.

TAIL UNIT.—Cantilever monoplane type with small auxiliary fins at extremity of tail-plane. Wooden structure. Variable-incidence tailplane and fin are plywood-covered; rudder and elevators fabric-covered. Area of horizontal surfaces 2.98 m.² (32 sq. ft.). Area of vertical surfaces 1.60 m.² (17.2 sq. ft.).

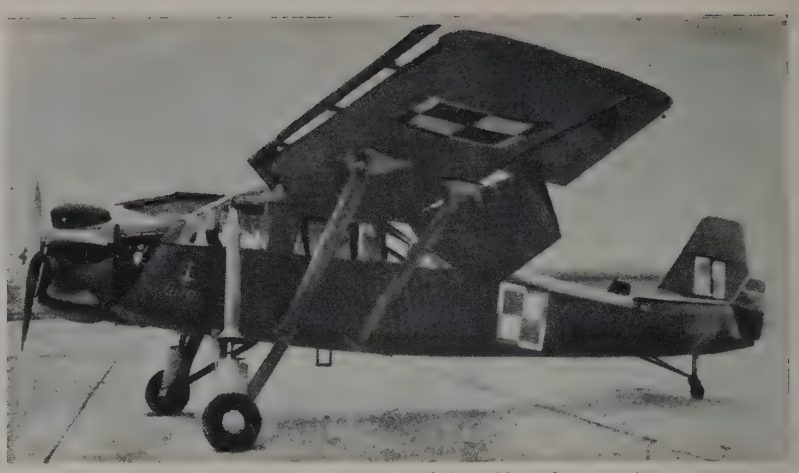
LANDING GEAR.—Fixed tail-wheel type. LWD oleo shock-absorbers with initial compression stroke of 160 mm. (6.24 in.) and total stroke of 235 mm. (9.16 in.). Low-pressure (3.59 kg./cm.²=51 lb./sq. in.) tyres size 500×180 mm. (19.5×7 in.). Hydraulic brakes. Solid, steerable, sprung tail-wheel size 165×70 mm. (5.5×2.7 in.).

POWER PLANT.—One M-11FR five-cylinder air-cooled radial engine giving 160 h.p. at 1,900 r.p.m. and driving a two-blade wooden airscrew, diameter 2.4 m. (7 ft. 10½ in.). Each of the cylinders is separately cowled, with exhaust outlet on port side of fuselage. Engine mounting has nine flexible pick-up points. Fuel in wing tanks.

ACCOMMODATION.—Enclosed cabin for two or three persons. Dual controls. Navigator's seat can be turned to face either forward or rearward. Access to cabin through two doors on starboard side, with hinged roof for loading stretchers. Provision for two-way radio.

DIMENSIONS.—
Span 11.7 m. (38 ft. 4 in.).
Width, wing folded 4.42 m. (14 ft. 5 in.).
Length 8.26 m. (27 ft.).
Height 2.56 m. (8 ft. 5 in.).

WEIGHTS AND LOADINGS (Zuraw I).—
Weight empty 899 kg. (1,978 lb.).
Weight loaded (two-seater) 1,157 kg. (2,545 lb.).
Wing loading 55.1 kg./m.² (11.28 lb./sq. ft.).
Power loading 7.23 kg./h.p. (15.9 lb./h.p.).



The prototype LWD Zuraw (160 h.p. M-11FR engine).

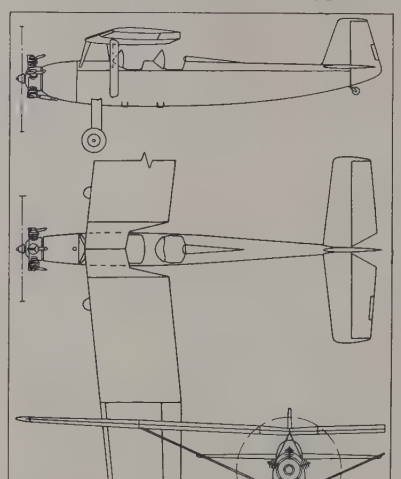
WEIGHT (Zuraw II).—
Weight loaded 1,250 kg. (2,750 lb.).

PERFORMANCE (Zuraw I).—
Max. speed 175 km.h. (109 m.p.h.).
Cruising speed 140 km.h. (87 m.p.h.).
Min. speed 60 km.h. (37 m.p.h.).
Max. permissible diving speed 300 km.h. (186 m.p.h.).
Rate of climb at S/L. 126 m./min. (410 ft./min.).
Service ceiling 2,500 m. (8,200 ft.).
Take-off run 264 m. (865 ft.).
Landing run 65-95 m. (215-310 ft.).
Range 950 km. (589 miles).

PERFORMANCE (Zuraw II, estimated).—
Max. speed 265 km.h. (164 m.p.h.).
Rate of climb at S/L. 470 m./min. (1,500 ft./min.).
Climb to 6,000 m. (19,680 ft.) 37 min.
Service ceiling 6,000 m. (19,680 ft.).

THE SZD KANIA.

Intended specifically for glider-towing, the S-3 Kania was designed by Dipl.-Ing. E. Stankiewicz and the prototype was built at the S.Z.D., or Szybowcowy Zaklad Doswiadczalny (Experimental Glider Establishment) at Lodz. It was flown for the first time on May 1, 1951 and, despite an urgent need for such an aircraft, was abandoned after only brief testing.



The SZD S-3 Kania.

The latest reorganisation of the Polish aircraft industry has enabled Stankiewicz to continue development of this design, and three prototypes of a new version, designated S-4 Kania 2, are nearing completion in the W.S.K. factory at Mielec.

TYPE.—Two-seat Glider-tug.

WINGS.—Braced parasol-wing monoplane. NACA 23012 wing section. Single-spar wood structure, in three portions. Outer wings have plywood-covered leading-edge and fabric covering aft of spar. Centre-section supported on pyramid structure of two pairs of steel Vee tubes and contains fuel tank. Wings attached to centre-section and braced each side by a single streamline strut. All-metal ailerons. Leading-edge slots with same span as ailerons. Wing area 20 m.² (215.3 sq. ft.).

FUSELAGE.—Oval plywood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane have plywood-covered wood structure. Elevators and rudder have metal framework with fabric covering.

LANDING GEAR.—Non-retractable tail-wheel type. Rubber-in-compression shock-absorbers. Low-pressure tyres. Hydraulic brakes. Swivelling tail-wheel with self-centring device.

POWER PLANT.—One 125 h.p. M-11D five-cylinder air-cooled radial engine, driving two-blade wooden airscrew. Fuel tank in centre-section.

ACCOMMODATION.—Two open cockpits in tandem, with dual controls, beneath cut-out in centre-section trailing edge. Large luggage compartment behind rear seat.

DIMENSIONS.—
Span 12 m. (39 ft. 4¾ in.).
Length 8 m. (26 ft. 3 in.).

WEIGHT.—
Weight empty, equipped 680 kg. (1,499 lb.).

PERFORMANCE.—
Cruising speed 160 km.h. (99.5 m.p.h.).
Min. speed 50 km.h. (31 m.p.h.).
Rate of climb at S/L 330 m./min. (1,085 ft./min.).
Ceiling 6,000 m. (19,685 ft.).
Take-off run 50 m. (165 ft.).



The SZD S-3 Kania (125 h.p. M-11D engine).

THE TS-8 BIES.

First aircraft of Polish design to emerge since the Soviet reorganisation of the national aircraft industry, and first to fly since the Spring of 1951, was the TS-8 Bies trainer. Designed by T. Soltyk in the design office formed at the I.L. in 1952, the first prototype flew on July 23, 1955 and the third prototype was shown in public at the Poznan Fair in July, 1956. Several more have since been completed and the Bies is in full production to replace the Junak. It is fully aerobatic and equipped for night and all-weather flying.

On December 28, 1956, a Bies piloted by A. Ablamowicz set up a new international height record for aircraft in the

FAI class C.1c, by attaining an altitude of 7,084 m. (23,242 ft.). Later, on May 14, 1957, a Bies established a closed circuit distance record of 2,884.5 km. (1,792.3 miles) in the same class, followed on May 20, 1957 by a speed record of 320.362 km.h. (199.06 m.p.h.) over a 2,000 km. (1,243 mile) closed circuit.

TYPE.—Two-seat Basic trainer.

WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section modified to give 13% t/c ratio. Aspect ratio 5.8. Incidence 0° at root, 3° at break, −1° at tip. All-metal structure. Wing in three sections, with centre-section integral with fuselage. Centre-section built around single duralumin main spar which passes through fuselage and is then swept back and down at anhedral angle inside centre-section. Nose-section torsion box formed by this spar and heavy gauge skin. Outer wings of conventional stressed-skin construction, without heavy spars. Ground-adjustable trim-tabs on ailerons. Pneumatically-operated slotted flaps. Ailerons and flaps have fabric-covered metal structure. Landing light and camera in port centre-section. Wing area 19.1 m.² (205.6 sq. ft.).

FUSELAGE.—Eliptical stressed-skin metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Fin integral with fuselage. Elevators and rudder fabric-covered. Trim-tab on port elevator adjustable in flight. Ground-adjustable tab on rudder.

LANDING GEAR.—Retractable tricycle type. Pneumatic retraction. Olco-pneumatic shock-absorbers. Main wheels fitted with low-pressure tyres size 400 × 50 mm. Pneumatic brakes. Fully-castoring, self-centring nose-wheel with hydraulic shimmy damper. Wheel track 2.35 m. (7 ft. 9 in.). Wheelbase 2.05 m. (6 ft. 9 in.).

POWER PLANT.—One Narkiewicz WN-3 seven-cylinder radial air-cooled engine rated at 320 h.p. at 2,350 r.p.m., with max. emergency power of 340 h.p. at 2,500 r.p.m. Prototypes fitted with variety of airscrews. Production aircraft will have W.R.1 two-blade constant-speed metal airscrew of 2.2 m. (7 ft. 3 in.) diameter. Three fuel tanks in lower fuselage. Total fuel capacity 215 litres (47 Imp. gallons).

ACCOMMODATION.—Two seats in tandem under continuous transparent jettisonable canopy, with instructor to rear. Section of canopy over each cockpit can be opened rearward individually. Fully-duplicated controls and instruments. Radio operated from front seat only.

ARMAMENT (optional).—Bomb rack under each wing for total of 200 kg. (440 lb.) practice bombs.

DIMENSIONS.—
Span 10.5 m. (34 ft. 5½ in.).
Length 8.5 m. (28 ft.).
Height 3.0 m. (9 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,070 kg. (2,359 lb.).
Weight loaded 1,550 kg. (3,417 lb.).
Max. weight loaded (instrument trainer) 1,600 kg. (3,525 lb.).
Wing loading 81.2 kg./m.² (16.62 lb./sq. ft.).
Power loading 4.85 kg./h.p. (10.68 lb./h.p.).

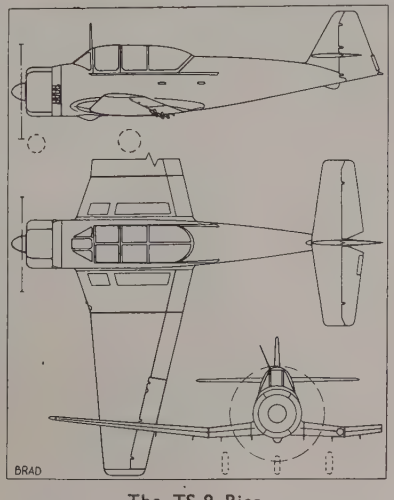
PERFORMANCE.—
Max. speed 310 km.h. (193 m.p.h.).
Cruising speed 270 km.h. (168 m.p.h.).
Landing speed 90 km.h. (56 m.p.h.).
Rate of climb at S/L 408 m./min. (1,340 ft./min.).
Service ceiling 5,000 m. (16,400 ft.).
Range 675 km. (420 miles).

THE TS JET TRAINER.

A two-seat jet trainer, intended eventually to replace the TS-8 Bies, has been designed by T. Soltyk. It is a mid-wing cantilever monoplane of all-metal construction, powered by a single turbojet engine. This is mounted in the lower part of the fuselage, with the jet nozzle under the fuselage aft of the wings. The bifurcated air intakes are below the forward fuselage. Other design features include a cantilever T-type tail unit and a retractable tricycle landing gear. The prototype flew in the summer of 1957.



The TS-8 Bies Basic Trainer (320 h.p. Narkiewicz WN-3 engine).



The TS-8 Bies.

THE M-2.

Under the supervision of their instructors, the students of Warsaw Politechnic have designed a series of four aircraft under the designations of M-1, M-2, M-3 and M-4.

Now under construction, the M-2 is a two-seat training and touring aircraft of all-metal construction. It is a low-wing cantilever monoplane with fixed tail-wheel type landing gear and powered by an unspecified horizontally-opposed air-cooled engine. The two seats are in tandem under a transparent sliding canopy, and equipment includes wing flaps, cabin heating, radio and blind-flying instruments.

DIMENSIONS.—
Span 9.5 m. (31 ft. 2½ in.).
Length 7.62 m. (25 ft. 0 in.).
Height 2.80 m. (9 ft. 2½ in.).

WEIGHT (designed).—
Weight loaded 970 kg. (2,138 lb.).

PERFORMANCE (estimated).—
Max. speed 270 km.h. (168 m.p.h.).
Service ceiling 7,200 m. (23,620 ft.).

THE M-3 PLISZKA (WAGTAIL).

Designed by students of Warsaw Politechnic, the M-3 is a single-seat glider of all-metal construction. Work on the prototype has begun. If it is successful, the M-3 will be put into large-scale production for export and the home market.

DIMENSIONS.—
Span 14 m. (45 ft. 11½ in.).
Length 6.7 m. (22 ft. 0 in.).

WEIGHT (estimated).—
Weight loaded 285 kg. (628 lb.).

THE M-4.

At present in the design stage, the M-4 is a projected single-seat sports and aerobatic aircraft of all-metal construction, which has been developed by students of Warsaw Politechnic from their original M-1 design. The M-1 itself will probably not now be built.

The M-4 will be a very clean low-wing cantilever monoplane with a retractable tricycle landing gear. Apart from the following dimensions, no other details are available.

DIMENSIONS.—
Span 8.2 m. (26 ft. 11 in.).
Length 6.5 m. (21 ft. 4 in.).

THE MD-12.

A small four-engined feeder-liner known as the MD-12 is being developed from the twin-engined CSS-12 by a design team working at the I.L. under Misztal and Duleba. A prototype is being built in the P.Z.L. works at Swidnik.

The MD-12 will be a low-wing all-metal aircraft of conventional design, powered by four 340 h.p. WN-3 seven-cylinder radial engines. It will carry a payload of 1,700 kg. (3,747 lb.), or 20 passengers and 200 kg. (440 lb.) of baggage. Later, the design may be adapted for turboprop power.

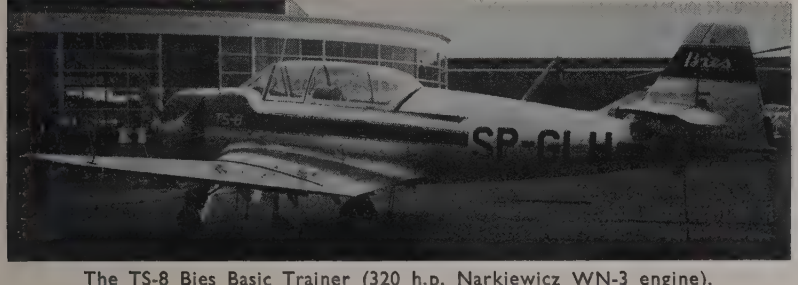
DIMENSIONS.—
Span 21.3 m. (70 ft.).
Length 16.0 m. (52 ft.).
Wing area 55 m.² (592 sq. ft.).

WEIGHT.—
Weight loaded 5,000 kg. (11,020 lb.).

PERFORMANCE.—
Cruising speed at 2,500 m. (8,200 ft.) 300 km.h. (186 m.p.h.).
Stalling speed 95 km.h. (59 m.p.h.).
Rate of climb at S/L 360 m./min. (1,180 ft./min.).
Take-off to 15 m. (50 ft.) 500-750 m. (1,640-2,460 ft.).
Max. range 700 km. (435 miles).

THE BZ-4 ZUK.

First displayed in the Polish Aviation Day Exhibition in August, 1956, the



The TS-8 Bies Basic Trainer (320 h.p. Narkiewicz WN-3 engine).

BZ-4 Zuk four-seat helicopter completed its ground testing by the Spring of 1957.

Work on the Zuk had begun at the I.L. in 1953, under the leadership of Eng. B. Zurakowski, who had earlier designed the experimental GIL helicopter, the first successful rotating-wing aircraft built in Poland. Due to the political situation, progress was slow and the main object was to produce a simple and inexpensive prototype to develop and test the novel rotor and transmission system, which eliminates vibration and improves control.

The production model will be redesigned, cleaned up and more comfortably furnished. It is expected to be produced by P.Z.L. at Swidnik, near Lublin, and four main variants are planned. These are a passenger version accommodating pilot and three passengers; an ambulance version carrying pilot, one stretcher case and attendant; an agricultural version carrying pilot and spraying or dusting equipment; and a dual control trainer.

TYPE.—Four-seat General purpose helicopter.

ROTOR SYSTEM.—Three-blade main rotor, small diameter three-blade servo-rotor above main rotor, and two-blade tail rotor. Main rotor blades of all-wood construction, except for a steel rod on leading-edge of spar to increase strength and keep the C.G. forward. Plywood covered. Main blades are rigidly mounted on hub, with no flapping hinge, but rotate about their longitudinal axis to permit cyclic pitch change. Servo-rotor consists of three metal blades of circular planform on short streamline stubs. These blades are rotated to vary their incidence, and a set of rockers joins the servo-rotor to the main rotor, acting on the main rotor blades in such a way that a change of plane of the servo-rotor head is transmitted as a cyclic pitch change for the main rotor. The servo-rotor thus decreases stick forces and stabilises the helicopter dynamically. The tail directional control and anti-torque rotor has two variable-pitch wooden blades attached rigidly to the hub.

ROTOR DRIVE. Centrifugal liquid-mercury clutch integral with engine connects it with transmission shaft leading to main gearbox, which is flexibly mounted to damp out oscillations in pitch and roll transmitted to fuselage by rotor. Main and servo-rotors connected to transmission shaft by universal couplings. Tail rotor drive is taken through intermediate gearbox, with a shaft running along tail-boom to final reduction gearbox near rotor.

FUSELAGE.—Tubular steel structure with forward portion only covered with duralumin sheet. Pilot and passengers in cabin in nose; engine bay aft of cabin and fuel tanks to rear of engine. Uncovered tubular steel tail-boom carries anti-torque rotor and tail-skid.

LANDING GEAR.—Fixed four-wheel type. Front wheels, with oleo shock-absorbers, castor through 360°. Rear wheels have oleo-pneumatic shock-absorbers.

POWER PLANT.—One 320 h.p. Narkiewicz WN-4 seven-cylinder radial air-cooled engine, mounted with crankshaft vertical. Engine-driven cooling fan and air intake above cabin. Starting by compressed air injection. Two fuel tanks with total capacity of 200 litres (44 Imp. gallons) aft of engine bay. Oil capacity, 20 litres (4.4 Imp. gallons).

ACCOMMODATION.—Prototype has two side-by-side seats with dual controls and provision for seat-type parachutes. Nose panelling hinges and starboard seat folds for stretcher loading. Radio, blind-flying and night navigation equipment fitted. Conventional helicopter controls.

DIMENSIONS.—
Diameter of main rotor 12 m. (39 ft. 4½ in.).
Overall length (maximum) 12.75 m. (41 ft. 10½ in.).
Height 2.6 m. (8 ft. 6½ in.).
Diameter of tail rotor 2.4 m. (7 ft. 10½ in.).

WEIGHTS.—
Weight empty 1,050 kg. (2,315 lb.).
Weight loaded 1,500 kg. (3,306 lb.).

PERFORMANCE (estimated).—
Max. speed 156 km.h. (97 m.p.h.).
Cruising speed 125 km.h. (78 m.p.h.).
Economical speed 80 km.h. (50 m.p.h.).
Max. vertical rate of climb 276 m./min. (905 ft./min.).
Hovering ceiling 600 m. (1,970 ft.).
Service ceiling 3,000 m. (9,840 ft.).
Range 260 km. (161 miles).
Endurance 2½ hours.



The BZ-4 Zuk Four-seat Helicopter (320 h.p. Narkiewicz WN-4 engine).

THE KOTLINSKI TRZMIEL (BUMBLE-BEE).

A new jet-powered helicopter named the Trzmiel was completed at the I.L. in the Spring of 1957 and was undergoing rotor spinning trials at the time of writing. It was designed by Jerzy Kotlinski, a former member of Zurakowski's team, and is powered by two Wojcicki pulse-jet units mounted at the tips of its two-blade rotor.

No other details are available.

THE SM-1.

SM-1 is the designation of the Polish-built version of the Russian Mi-1 general purpose helicopter, a full description of which appears in the Soviet section of this work. It is being built in the P.Z.L. works at Swidnik, where the first production SM-1 was completed in the Spring of 1956.

THE IS-3 ABC-A.

The ABC-A is a single-seat strut-braced high-wing primary training glider of very simple wooden construction. It has a two-spar wing, built in two panels and fitted with ailerons which are not differentially operated. The landing gear consists of a sprung wooden skid mounted under the cockpit nacelle, with a folding wheel behind it to facilitate ground handling. An enclosed cockpit is optional.

DIMENSIONS.—
Span 9.0 m. (29 ft. 6 in.),
Length 6.0 m. (19 ft. 8 in.).
Height 1.64 m. (5 ft. 4 in.).

WEIGHT AND LOADING.—
Weight loaded 200 kg. (440 lb.).
Wing loading 13.7 kg./m.² (2.82 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio at 53 km.h. (33 m.p.h.) 9.2 : 1.
Min. sinking speed at 48 km.h. (30 m.p.h.) 1.52 m./sec. (4.98 ft./sec.).
Stalling speed 45 km.h. (28 m.p.h.).
Max. winch speed 95 km.h. (59 m.p.h.).
Max. aero-tow speed 125 km.h. (77 m.p.h.).
Max. permissible free flight speed 135 km.h. (83 m.p.h.).

THE MUCHA 100.

The Mucha 100 single-seat training glider is an improved version of the earlier Mucha-ter, which set up several national records for altitude and distance. It has an all-wood structure. The cantilever wings have a single main spar and oblique auxiliary spar, and have a plywood-covered leading-edge torsion box. The ailerons are aerodynamically and mass balanced, and air brakes are fitted.

The oval-section fuselage is plywood-covered and the cockpit has a streamlined Plexiglas canopy. The landing gear consists of short front and rear skids sprung with rubber pads, and a transport monowheel.

DIMENSIONS.—
Span 15.0 m. (49 ft. 2½ in.).
Length 7.0 m. (22 ft. 11½ in.).
Height 1.65 m. (5 ft. 5 in.).

WEIGHT AND LOADING.—
Weight loaded 290 kg. (638 lb.).
Wing loading 17.3 kg./m.² (3.53 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio at 70 km.h. (43.5 m.p.h.) 24 : 1.
Min. sinking speed at 60 km.h. (37.3 m.p.h.) 0.77 m./sec. (2.53 ft./sec.).
Stalling speed 50 km.h. (31 m.p.h.).
Max. winch speed 94 km.h. (58 m.p.h.).
Max. aero-tow speed 130 km.h. (81 m.p.h.).
Max. diving speed 220 km.h. (136 m.p.h.).

THE SALAMANDRA 53.

An intermediate single-seat training glider, the Salamandra is a braced high-wing monoplane of all-wood construction. The single-spar wing is built in two panels and is fitted with differential ailerons and air brakes. The landing gear consists of a rubber-sprung wooden skid under the open cockpit nacelle.

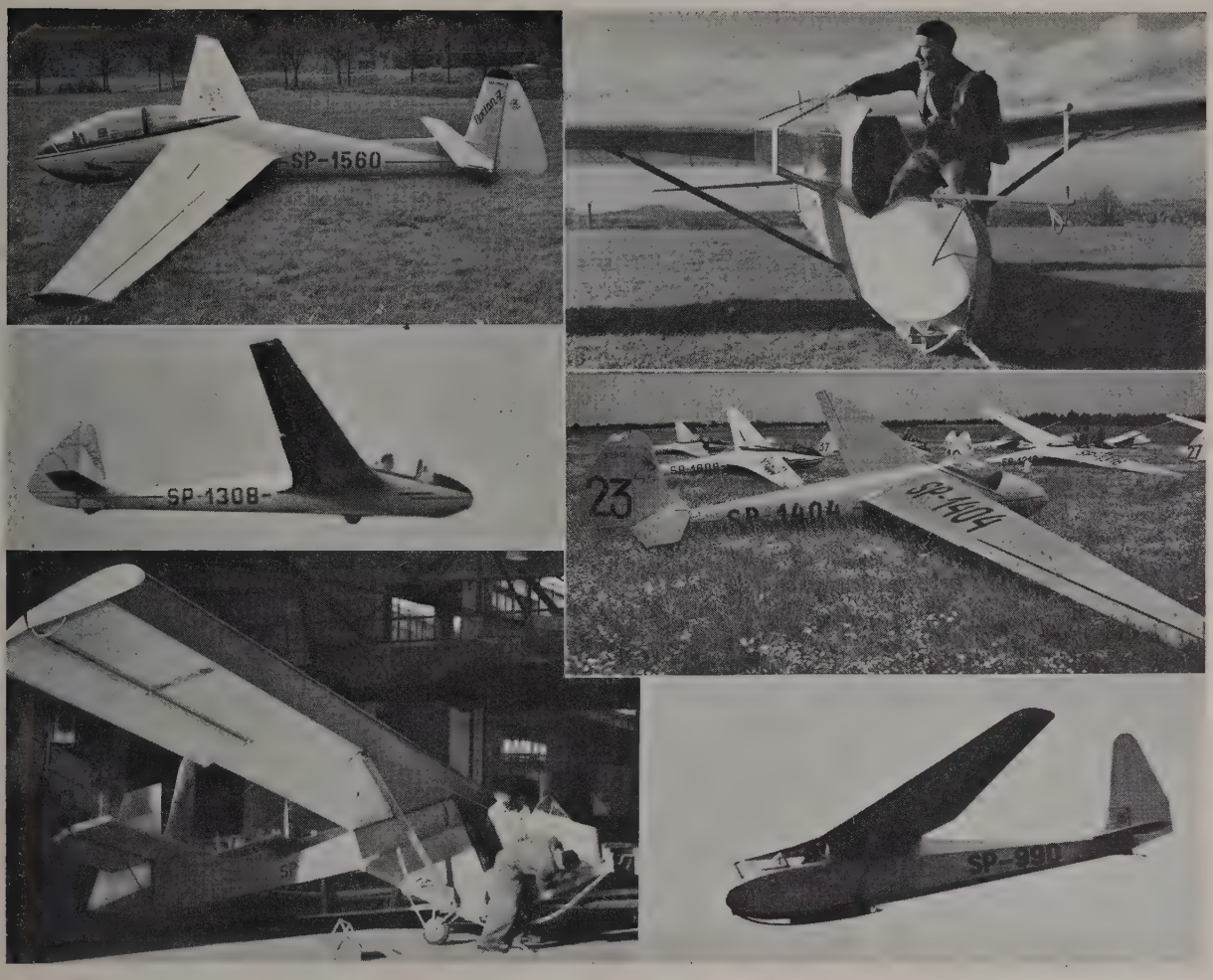
DIMENSIONS.—
Span 12.50 m. (40 ft. 10 in.).
Length 6.50 m. (21 ft. 4 in.).
Height 2.30 m. (7 ft. 6 in.).

WEIGHT AND LOADING.—
Weight loaded 225 kg. (495 lb.).
Wing loading 13.30 kg./m.² (2.73 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio at 49 km.h. (30.5 m.p.h.) 12.2 : 1.



The SM-1, the Polish-built version of the Russian Mi-1 Helicopter.



Some Polish Sailplanes and Gliders. *Top left*, the Bocian two-seat high-performance sailplane; *top right*, the Sroka single-seat sailplane ; *middle left*, the Jaskolka single-seat high-performance sailplane ; *middle right*, the Mucha-100 single-seat training glider ; *bottom left*, the Czajka two-seat training glider ; *bottom right*, the SG-38 single-seat training glider.

Min. sinking speed at 47 km.h. (29.2 m.p.h.) 0.85 m./sec. (2.79 ft./sec.).
Stalling speed 35 km.h. (21.7 m.p.h.).
Max. winch speed 80 km.h. (50 m.p.h.).
Max. free flight speed 150 km.h. (93 m.p.h.).

THE SZD-8*bis* JASKOLKA (SWALLOW).

Holder of several world records for speed and distance, the Jaskolka is a single-seat high-performance sailplane of wooden construction. The quickly detachable mid-set cantilever wings are of single-spar construction, plywood-covered, and fitted with aerodynamically-balanced ailerons, Fowler flaps and dive brakes. The fuselage is plywood-covered and the cockpit is enclosed by a sliding Plexiglas canopy.

A monowheel landing gear is fitted, with a mechanical brake, and there are also a short front skid and tail bumper.

DIMENSIONS.—
Span 16.00 m. (52 ft. 6 in.).
Length 7.42 m. (24 ft. 4 in.).
Height 1.41 m. (4 ft. 7½ in.).

WEIGHT AND LOADING.—
Weight loaded 340 kg. (749 lb.).
Wing loading 25 kg./m.² (5.12 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio at 80 km.h. (50 m.p.h.) 26.4 : 1.
Min. sinking speed at 68 km.h. (42.3 m.p.h.) 0.76 m./sec. (2.49 ft./sec.).
Max. winch speed 110 km.h. (68 m.p.h.).
Max. aero-tow speed 150 km.h. (93 m.p.h.).
Max. diving speed 250 km.h. (155 m.p.h.).

THE SZD-8 L JASKOLKA (SWALLOW).

Produced for the 1956 World Championships, the SZD-8L is the latest version of the Jaskolka single-seat high performance sailplane. New features include a laminar flow wing, butterfly-type tail and wing-tip end plates which have the effect of increasing the span as well as acting as "bumpers." In addition, the SZD 8L carries a reserve of 100 litres (22 Imp. gallons) of water ballast to permit maximum performance in varying weather conditions.

THE SZD-9*bis* BOCIAN.

The Bocian is a high-performance two-seat sailplane with swept-forward wings, which holds several world records for speed over 200 and 300 km. closed circuits.

Of all-wood construction, the Bocian has a mid-set cantilever single-spar wing with plywood-covered leading-edge torsion box. Each aileron is in two parts, separately controlled. No flaps are fitted, but there are air-brakes inboard of the ailerons.

The fuselage is plywood-covered and the tandem seats are so arranged that the rear seat is over the C.G. and no ballast need be carried when the aircraft is flown as a single-seater. The landing gear consists of a braked monowheel and short front skid.

DIMENSIONS.—
Span 18.115 m. (59 ft. 2½ in.).
Length 7.945 m. (27 ft. 1 in.).
Height 1.98 m. (5 ft. 10 in.).

WEIGHT AND LOADING.—
Weight loaded 500 kg. (1,103 lb.).
Wing loading 25 kg./m.² (5.12 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio at 80 km.h. (50 m.p.h.) 26 : 1.
Min. sinking speed at 71 km.h. (44 m.p.h.) 0.82 m./sec. (2.69 ft./sec.).
Stalling speed 52 km.h. (32.3 m.p.h.).
Max. winch speed 115 km.h. (71.4 m.p.h.).
Max. aero-tow speed 140 km.h. (87 m.p.h.).
Max. diving speed 200 km.h. (124 m.p.h.).

THE CZAPLA.

The Czapla is a two-seat glider suitable for primary training, dual control instruction, solo flying and aerobatics. It is a strut-braced high-wing aircraft of all-wood construction, except for the metal bracing struts. The single-spar wings are fitted with air brakes and aerodynamically-balanced ailerons with trim-tabs. The fuselage is plywood-covered and the cockpit has a sideways-hingeing Plexiglas canopy.

The monowheel landing gear is carried between two telescopic shock-absorbers and is fitted with a brake. There are also short rubber-sprung nose and tail skids.

DIMENSIONS.—
Span 16.00 m. (52 ft. 6 in.).
Length 8.37 m. (27 ft. 6 in.).
Height 1.98 m. (5 ft. 10 in.).

WEIGHT AND LOADING.—
Weight loaded 440 kg. (968 lb.).
Wing loading 17.5 kg./m.² (3.50 lb./sq. ft.).

PERFORMANCE.—
Best glide ratio at 64 km.h. (40 m.p.h.) 17.1 : 1.
Min. sinking speed at 52 km.h. (32 m.p.h.) 0.96 m./sec. (3.15 ft./sec.).
Stalling speed 40 km.h. (25 m.p.h.).
Max. winch speed 100 km.h. (62 m.p.h.).
Max. aero-tow speed 110 km.h. (68 m.p.h.).
Max. diving speed 160 km.h. (99.4 m.p.h.).

PORTUGAL

GOVERNMENT WORKSHOPS

OFICINAS GERAIS DE MATERIAL AERONAUTICO (GENERAL AERONAUTICAL MATERIAL WORKSHOPS).

ALVERCA DO RIBATEJO.

Director: Colonel Engineer Bernardo Tiago Mira Delgado.

Sub-Director: Lieut. Colonel Engineer Fernando Alberto de Oliveira.

This factory, a department of the Portuguese Air Force, performs all repair and overhaul work for the Air Force as well as for civil aviation.

Aircraft and engines of various types have been built under licence. At present the de Havilland Chipmunk is in production.

Steel structures and ground equipment are also currently manufactured.

RUMANIA

Before the war the principal aircraft and aero-engine manufacturing organization in Rumania was the Regia Autonoma Industria Aeronautica Romana, a State establishment controlled by the Ministries of War and Marine. Apart from building aircraft of its own design under the initials I.A.R. for the Rumanian Air Force, it also manufactured Gnôme-Rhône engines under licence. It had previously built Morane-Saulnier, Potez, Fleet (U.S.A.) and PZL (Polish) aircraft under licence.

After the war the I.A.R. factory at Brasov was de-militarised by the Russian occupation authorities and later a Russo-Rumanian commercial agreement provided for the conversion of the establishment into a general engineering undertaking under joint Russo-Rumanian ownership under the name Sovromtractor. Its principal production is, as its name implies, tractors and agricultural machinery.

SOVROMTRACTOR

PROJECT ENGINEERING DIVISION.

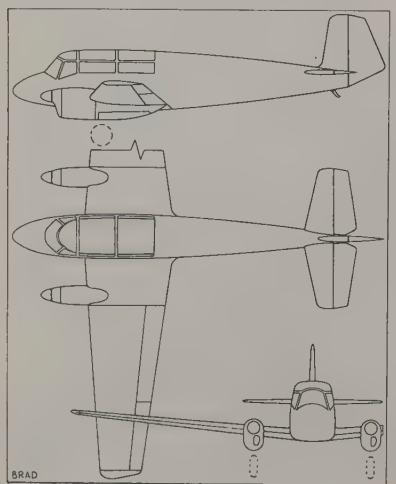
HEAD OFFICE AND WORKS: BRASOV.

The Project Engineering Division of Sovromtractor is mainly under Russian administration. It has produced four types of light aircraft of which the following details are available.

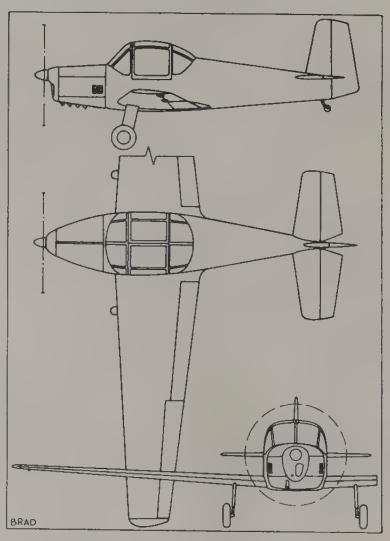
THE I.A.R. 811.

The I.A.R. 811 was the first aircraft of original design to be produced in Rumania since the country was Sovietised. It was a light two-seat training monoplane powered by a 60 h.p. Train engine, a French power-unit no longer in production.

The original I.A.R. 811 flew for the first time in May, 1949, and a slightly-modified version with 65 h.p. Walter Mikron engine was later put into limited production.



The I.A.R. 814.



The I.A.R. 813.

THE I.A.R. 813.

The I.A.R. 813, which is in production at Brasov, is a progressive development of the I.A.R. 811.

TYPE.—Two-seat light sports and training aircraft.

WINGS.—Cantilever low-wing monoplane. Single-spar wood structure, plywood-covered. Trailing-edge flaps. Wing area 17 m.² (182.98 sq. ft.).

FUSELAGE.—Composite construction.

TAIL UNIT.—Cantilever monoplane type.

LANDING GEAR.—Non-retractable tail-wheel type. Cantilever main legs.

POWER PLANT.—One 160 h.p. Walter Minor 6-III six-cylinder in-line inverted air-cooled engine driving two-blade fixed-pitch wooden airscrew.

ACCOMMODATION.—Two seats side-by-side under transparent sliding canopy, with instructor's seat to starboard. Canopy is divided on centre-line and each half can be opened independently. Dual controls.

DIMENSIONS.—
Span 10.3 m. (33 ft. 10 in.).
Length 5.9 m. (19 ft. 4 in.).

WEIGHT.—
Weight loaded 700 kg. (1,543 lb.).

PERFORMANCE.—
Max. speed 185 km.h. (115 m.p.h.).
Landing speed 65 km.h. (40.4 m.p.h.).
Ceiling 4,200 m. (13,780 ft.).
Range 500 km. (310 miles).

THE MR-2 (I.A.R. 814).

A design study for a twin-engined air taxi, touring and ambulance aircraft known as the I.A.R. 814 was completed in 1953, and construction of two prototypes began in the following year. After these aircraft had completed their flight tests successfully, the type was put into production as a general-purpose aircraft under the designation MR-2.

The MR-2 is a low-wing cantilever monoplane powered by two 160 h.p. Walter Minor 6-III six-cylinder inverted in-line air-cooled engines and with accommodation for four passengers or two stretcher cases in addition to crew. Alternatively, up to 500 kg. (1,100 lb.) of freight can be carried when the passenger seats are removed. Blind-flying equipment and radio are fitted as standard.

The wing centre-section, carrying the engines, is built integrally with the fuselage, and flaps are fitted to the outer wings. The landing gear is retractable. Maximum fuel capacity is 340 litres (74.7 Imp. gallons) and oil capacity 36 litres (7.9 Imp. gallons).

DIMENSIONS.—
Span 14 m. (45 ft. 11 in.).
Length 11.05 m. (36 ft. 3 in.).
Height 4.2 m. (13 ft. 9 in.).

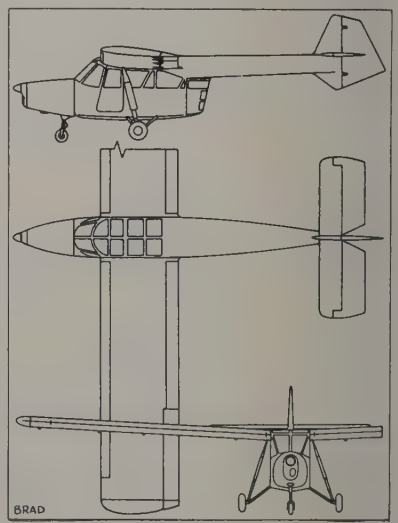
WEIGHT.—
Weight loaded 2,060 kg. (4,541 lb.).

PERFORMANCE.—
Max. speed 272 km.h. (169 m.p.h.).
Cruising speed 250 km.h. (155 m.p.h.).
Landing speed 90 km.h. (56 m.p.h.).
Climb to 3,000 m. (9,840 ft.) 22 min.
Ceiling 5,300 m. (17,385 ft.).
Range 875 km. (545 miles).

THE I.A.R. 817.

The I.A.R. 817 is a light general-purpose monoplane intended for a variety of rôles, including liaison, postal, agricultural and ambulance duties. It is powered by a 160 h.p. Walter Minor 6-III six-cylinder inverted in-line air-cooled engine and seats two persons side-by-side. The prototype was completed towards the end of 1955 and production is contemplated.

The I.A.R. 817 is a high-wing cantilever monoplane with non-retractable nose-wheel landing gear. The wings are of parallel chord and section and are equipped with leading-edge slots over almost the entire span as well as trailing-edge flaps.

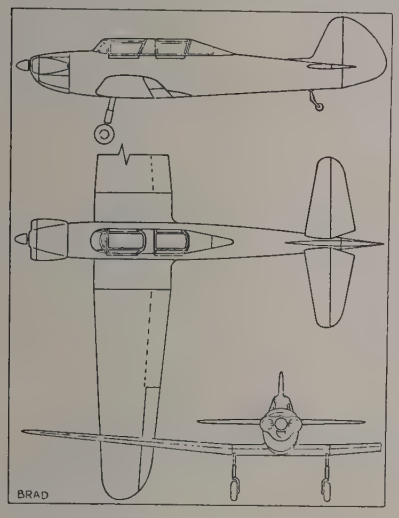


The I.A.R. 817.

These features help to give the aircraft a very short landing and take-off run, even when operated from unprepared airfields. The wings can also be dismantled quickly for transport or to enable the aircraft to be towed behind a car.

The rectangular-section fuselage comprises the power plant, crew cabin with a door on each side and a cargo-space behind the seats, and a tail-boom carrying a conventional monoplane tail unit. The rear end of the cabin section is made up of two sideways-opening clamshell doors which give access to the full height and width of the cargo-space for direct loading.

No further details are available.



The RG-6 Two-seat Light Monoplane.



The RG-6 Two-seat Light Monoplane (75 h.p. Praga "D" engine).

THE RG-6.

Designed by V. Novicki and built at the LFIL-Reghin factory, the RG-6 two-seat light aircraft had completed its flight testing by the beginning of 1957 and had been ordered into production. At the same time, a more powerful fully-aerobatic version, designated the RG-7, was under development.

Intended for training and touring, the RG-6 is a cantilever low-wing monoplane of all-wooden construction, powered by a 75 h.p. Praga "D" four-cylinder horizontally-opposed air-cooled engine and fitted with a non-retractable tail-wheel type of landing gear. Accommodation comprises tandem cockpits under a continuous transparent canopy, with a separate sideways-hingeing section over each seat. Dual controls are fitted.

The wing is built in three sections, consisting of a two-spar centre-section built integrally with the fuselage, and two outer panels with a single main box-spar and an auxiliary rear spar to which the ailerons and flaps are hinged. Two fuel tanks with a total capacity of 70 litres (15.4 Imp. gallons) are carried in the centre-section, with a small reserve tank of 9 litres (2 Imp. gallons) capacity, behind the fuselage firewall.

DIMENSIONS.—
Span 10.5 m. (34 ft. 5½ in.).
Length 7.4 m. (24 ft. 3½ in.).
Height 2.62 m. (8 ft. 7½ in.).
Wing area 14.5 m.² (156 sq. ft.).

WEIGHT.—
Weight loaded 660 kg. (1,455 lb.).

PERFORMANCE.—
Max. speed at S/L 180 km.h. (112 m.p.h.).
Cruising speed at 2,500 m. (8,200 ft.) 143 km.h. (88 m.p.h.).
Landing speed 55 km.h. (34 m.p.h.).
Service ceiling 3,200 m. (10,500 ft.).
Max. endurance 5 hrs.

THE SOVIET UNION

(Union of Soviet Socialist Republics)

In 1954 the question of designations for unidentified aeroplanes took one of its periodic swings, this time in favour of code-names for Russian types. They were proposed by the U.S. Navy and Air Force and have been adopted by N.A.T.O. They supplant the previous system of Type Numbers.

Russian aeroplanes are now divided into Bomber, Cargo, Fighter, Helicopter and Miscellaneous categories, the code names being alliterative. Propeller-driven aircraft have names of one syllable while turbine-powered aircraft have two-syllable names.

CODE NAMES.

Fighters.

Fagot (ex-Falcon)	MiG-15.
Fang	La-11.
Fantail	La-(15?)
Fargo	MiG-9.
Farmer	MiG-19.
Feather	Yak-17.
Fin	La-7
Fishbed	Su-?
Fishpot	Su-?
Flashlight	Yak-25
Flora	Yak-23
Fresco	MiG-17.
Fritz	La-9.

Bombers.

Badger	Tu-16.
Barge	Tu-?
Bark	Il-2.
Bat	Tu-2.
Beagle (ex-Butcher)	Il-28.
Bear	Tu-?
Beast	Il-10.
Bison	Il- ?
Bob	Il-4.
Bosun	Tu-14.
Buick (ex-Buck)	Pe-2.
Bull	Tu-4.

Cargo.

Cab	Li-2.
Camel	Tu-104.
Camp	An-8.
Cart	Tu-70.
Cat	An-10
Coach	Il-12.
Colt	An-2.
Cork	Yak-16.
Crate	Il-14.
Creek	Yak-12
Crib	Yak-6.
Crow	Yak-14.

Helicopters.

Hare	Mi-1.
Horse	Yak-24.
Hound	Mi-4.

Miscellaneous.

Madge	Be-6
Magnet	Yak-17 UTI
Mascot	Il-28 U.
Max	Yak-18.
Midget	MiG-15 UTI
Mink	UT-2.
Moose	Yak-11.
Mule	Po-2.

ANTONOV

OLEG KONSTANTINOVICH ANTONOV.

Antonov, an important glider designer, has a number of his sailplane types, and probably some cargo-gliders, in use in the U.S.S.R. The A-1 is a single-seat elementary training glider; the A-2 is a modernised version of the US-5 two-seat training glider (see the 1951-52 edition); and the A-9 and A-10 are single and two-seat high-performance sailplanes. In 1953 Viktor Ilchenko, in an A-10, made a record "straight-line" flight of 829.82 km, (516 miles).

In early 1952, Antonov and three collaborators were awarded a Stalin Prize of 100,000 roubles for work in the field of aircraft construction in the "transport and commercial" section. This may have been a reward for the success of the An-2, described hereafter.

THE AN-2.
NATO Code Name: "Colt."

The An-2, which was built to a specification of the Ministry of Agriculture and Forestry of the U.S.S.R. as a replacement for the Il-12, Li-2 and Po-2 Series, first flew in 1947 under the designation SKh-1 (Selskokhozyaistvennyi-1 = agricultural-economic-1). It was later officially designated An-2.

The An-2 is capable of operating out of small airfields and has now taken over most of the duties of the versatile Po-2, such as rescue and ambulance work, passenger and cargo transport, photographic and geophysical survey, forestry patrol and agricultural work, parachute training, etc.

A large number of An-2's are now in service with the Armed Forces and with Aeroflot, Polyarnaya Aviatsiya and probably Aviaarktika. The type has been exported to a number of Socialist States, including East Germany, China and Bulgaria.

Early An-2's had an ASh-21 engine, but the current production models have an ASh-62IR engine. The following versions exist.

An-2. Standard general-purpose aircraft.

An-2S. Agricultural biplane, differing mainly in having a long-stroke landing gear. This permits the installation of pumping and spraying equipment under the fuselage and wings.

An-2V (design bureau number An-6). Floatplane version of An-2. In series production following tests in 1954-55. Floats are approximately 7.5 m. (24 ft. 7 in.) long and, as they have a very shallow draught, the An-2V can be used in water 0.8-1.2 m. (2 ft. 7½ in. to 3 ft. 11 in.) deep. Curved-blade airscrew of An-2 replaced by one with straight, blunt-ended blades.

An-2ZA (design bureau number An-4). For high-altitude meteorological research. Has an extra cockpit immediately forward of the fin, from which ice accretion and other weather phenomena may be watched. Powered by an ASh-62 IR/TK engine, with a turbo-compressor mounted externally on the starboard side to maintain 850 h.p. up to a height of 9,500 m. (31,000 ft.). Other modifications include deletion of the airscrew spinner and a longer carburettor air intake. Unslotted ailerons are installed on this version, which is fitted with a glider-towing hook.

An An-2ZA established an FAI-recognised height record of 11,248 m. (36,880 ft.), on July 19, 1954, as well as an earlier record in the previous year.

The following data apply specifically to the standard An-2.

TYPE.—Single-engined General Purposes biplane.

WINGS.—Unequal-span single-bay biplane. Metal structure, fabric-covered. I-type interplane struts. Approximately 2.8° dihedral on both wings. Slotted flaps on all four wings, slotted ailerons and auto-slots on upper wings only.

FUSELAGE.—All-metal stressed-skin structure of circular section forward of cabin, rectangular in the cabin section and oval in the tail section.

TAIL UNIT.—Braced monoplane type. Fin integral with rear fuselage.

LANDING GEAR.—Fixed split-axle type with long-stroke oleo shock-absorbers. Pneumatic brakes. Wheels interchangeable with floats or skis.

POWER PLANT.—One 1,000 h.p. ASh-62 IR nine-cylinder radial air-cooled engine. Four-blade airscrew. Fuel tanks in upper wings. Total capacity 1,280 litres (280 Imp. gallons).

ACCOMMODATION.—Flight compartment forward of upper wing seats two side-by-side with dual controls. Cabin provides accommodation for up to 10 passengers or 1,500 kg. (3,306 lb.) of freight or six stretchers. Large door on port side.

EQUIPMENT.—Wide range of equipment may be installed for various duties. For photographic survey and other work two fixed semi-automatic AFA-33/50 or one



The An-2S Agricultural Biplane (1,000 h.p. ASh-62 IR engine).

AFA-33/75 and one AFA 18/21 cameras are used; for agricultural work M-600 pump, fluid containers of 1,000 litres (220 gal.) capacity, etc. are provided; for geological survey a Geiger-Müller apparatus, magnetometer, etc. are fitted.

DIMENSIONS.—
Span 16.46 m. (54 ft. 2¼ in.).
Length 10.42 m. (34 ft. 3 in.).
Height 4.7 m. (15 ft. 5 in.).

WEIGHTS.
Weight empty 2,720 kg. (5,985 lb.).
Payload 1,500 kg. (3,300 lb.).
Max. loaded weight 5,000 kg. (11,000 lb.).

PERFORMANCE.—
Max. speed at S/L. 250 km.h. (155 m.p.h.).
Speed at 2,000 m. (6,560 ft.) 220 km.h. (137 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Minimum speed 64 km.h. (40 m.p.h.).
Climb to 4,000 m. (13,120 ft.) 40 min.
Service ceiling 8,230 m. (27,000 ft.).
Landing run 150 m. (490 ft.).
Max. range 1,200 km. (745 miles).

THE ANTONOV NRK.

The NRK, a prototype of which was being evaluated for military purposes in 1956, is a variant of the An-2 produced as a slow-flying artillery-control and reconnaissance aeroplane.

It has twin fins and rudders, to permit installation of a tail turret with a single 23 mm. cannon. Otherwise it is thought to be identical with the standard An-2.

THE AN-3.
NATO Code Name: "Camp."

The design of this twin-engined transport aeroplane was originated in 1952-1953, and the prototype was first exhibited publicly at Tushino in 1956. The design bureau number is An-8; if the aeroplane goes into national service in the U.S.S.R. the designation may be An-4. It has earned the sobriquet "*Letayushchii kit*—flying whale."

TYPE.—Twin-engined Passenger and Freight-carrying monoplane.

WINGS.—High aspect ratio cantilever type, with slight dihedral from roots.

FUSELAGE.—All-metal structure sharply swept up towards tail to permit entry of bulky loads through rear ventral doors.

TAIL UNIT.—Cantilever tailplane; fin and rudder with dorsal extension.

LANDING GEAR.—Retractable tricycle type. Multiple main wheels retract into blisters at sides of lower fuselage under the wing.

POWER PLANT.—Two 5,100 h.p. Kuznetsov turboprop engines.

ACCOMMODATION.—Pilots sit above navigator, whose compartment is in the glazed nose of the fuselage. The prototype has a manned tail gun position under the rudder. The main cabin can accommodate about thirty troops.

EQUIPMENT.—Navigational radar in blister under nose; full radio.

DIMENSIONS (approx.).—
Span 30 m. (98 ft. 5 in.).
Length 26 m. (85 ft. 4 in.).

WEIGHTS.—
Normal weight loaded 35,000 kg. (77,160 lb.).
Max. weight loaded 40,000 kg. (88,185 lb.).



The An-2ZA High-Altitude Meteorological Research Biplane.

THE AN-10 UKRAINA (THE UKRAINE.)

Design of the An-10 passenger transport aeroplane began in November, 1955 and it first flew in February, 1957.

TYPE.—Four-engine passenger Transport.

WINGS.—Cantilever high-wing monoplane. All-metal construction. Sweep-back on leading edge from roots.

FUSELAGE.—Circular stressed-skin monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Small stabilising fin under rear fuselage.

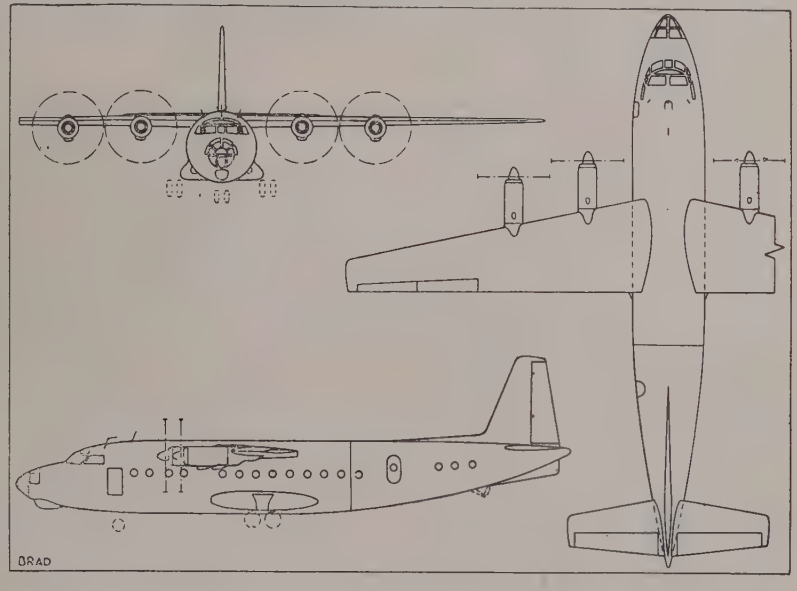
LANDING GEAR.—Retractable tricycle type. Four-wheel bogie on each side retracts into blister at fuselage side; dual nose-wheels.

POWER PLANT.—Four 4,000 h.p. Ivchenco (Kuznetsov) turboprops driving four-blade airscrews, diameter 4.57 m. (15 ft.).

ACCOMMODATION.—Crew of five. Fully-pressurised main cabin can accommodate 84-126 passengers in six-abreast seating, plus 3½ tons of freight.

DIMENSIONS (approx.).—
Span 43 m. (141 ft.).
Length 36.3 m. (119 ft.).
Height 11.4 m. (37 ft. 5 in.).

WEIGHTS.—
Max. payload 12,000 kg. (26,455 lb.).
Weight loaded approx. 54,450 kg. (120,000 lb.).



The An-10 Ukraina Airliner.



The An-10 Ukraina Airliner (four 4,000 h.p. Ivchenco (Kuznetsov) turboprop engines).



The An-10 Ukraina Airliner (four 4,000 h.p. Ivchenco (Kuznetsov) turboprop engines).

PERFORMANCE.—
Max. speed 720 km.h. (447 m.p.h.).
Cruising speed at 8,000 m. (25,000 ft.) 550 km.h. (342 m.p.h.).
Take-off distance 750 m. (2,460 ft.).
Max. range 5,000 km. (3,100 miles).

THE AN-14 PCHELKA (LITTLE BEE).

The An-14 Pchelka (Little Bee) is a light general purpose aircraft. It is a twin-engined braced high-wing monoplane with a tricycle undercarriage. The very large twin fins and rudders are carried on a tail-boom to permit easy loading of the cabin through large rear loading doors. As a passenger-carrying aircraft it will accommodate seven persons.

Designed for economical production, the Pchelka has short-run performance, making it suitable for agricultural, ambulance or transport duties. It is reported to have a maximum speed of 200 km.h. (124 m.p.h.) and to land at 35 km.h. (22 m.p.h.). It requires a runway of only 35-55 m. (115-180 ft.).



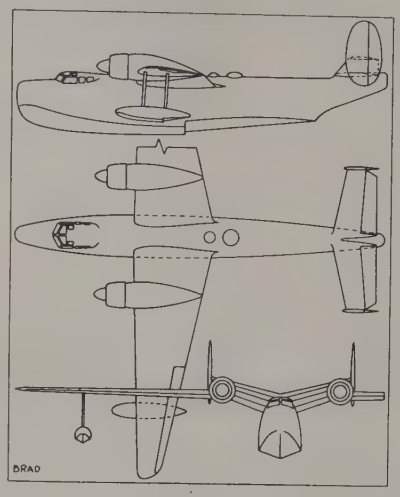
The An-14 Pchelka Light General Purpose Monoplane.

BERIEV

G. M. BERIEV.

Beriev is one of a number of Soviet designers about whose work relatively little is known. He may have studied under Grigorovich, and has been working on seaplanes since the late 1920's or early 1930's.

The Be-6 has been in small-scale service with Aeroflot and the Military-Aviation Forces of the Marine Fleet since approximately 1949-50; what is thought to have been the prototype or an early production model appeared at Tushino in 1951 (see this Annual, 1952-53 edition).



The Beriev Be-6.

THE BE-6.

NATO Code Name: "Madge."

TYPE.—Twin-engined Reconnaissance and Transport Flying-boat.
WINGS.—Gull-type wing of high aspect ratio, tapered from roots.
FUSELAGE.—Flying boat hull, with two steps.
TAIL UNIT.—Dihedral tailplane with end-plate twin fins and rudders.
LANDING GEAR.—Hull; floats near wing-tips.
POWER PLANT.—Two 2,000 h.p. ASh-73 radial engines.
ACCOMMODATION.—Crew of eight.
DIMENSIONS.—
Span 33 m. (108 ft. 3¼ in.).
Length approx. 25.6 m. (84 ft.).
WEIGHT.—
Loaded weight 23,400 kg. (51,588 lb.).
PERFORMANCE.—
Max. speed at 2,400 m. (7,875 ft.) 415 km.h. (258 m.p.h.).
Min. speed 155 km.h. (96 m.p.h.).
Range 4,900 km. (3,045 miles).

THE BE-8 (?).

The Be-8 was reported in 1952 or 1953. It is a version of the Be-6 powered by two VK-1 turbojet engines, and is thought to be experimental only.

ILYUSHIN

SERGEI VLADIMIROVICH ILYUSHIN.

Ilyushin is an active designer of diverse aircraft types. In March, 1952, in collaboration with ten co-workers, he was awarded a Stalin Prize of 150,000 roubles for "new work in aircraft construction." At the time of writing he is represented mainly by the Il-10, Il-12, Il-14 and Il-28, which are in widespread service, and a swept-wing bomber, probably derived from the Il-28, has also been reported to be in service.

In addition, the four-jet bomber to which the NATO code-name of "Bison" has been allocated is believed to be an Ilyushin design.

THE IL-?.

NATO Code Name: "Bison."

This four-jet bomber first became known in the Summer of 1953 and was first exhibited in the air on May Day, 1954. It is believed to be an Ilyushin design.

The "Bison" is of clean modern overall design though it lacks some of the refinements of modern Western bombers. Radio and radar aids are thought to be rather dated and the fire control system may not be a very great advance on that of the Tu-4. However, the "Bison" is a formidable weapon on account of its speed, range and bomb-carrying capacity and production was thought to be running at around 15 a month in early 1956.

Quantitative data below are estimates.

TYPE.—Four-jet Long-range Heavy Bomber.

WINGS.—Mid-wing cantilever monoplane with some anhedral and with thickened centre-section to house engines. The centre-section has a straight trailing edge and a leading-edge more sharply swept than the outer wing panels, and its construction may be integral with the bomb-bay and part of the fuselage. There is a single main spar, and auxiliary spars at the leading-edge and ahead of the ailerons and flaps which occupy about one-fifth of the wing chord. The flaps are of the single slotted type. A single boundary-layer fence is fitted above each wing.

FUSELAGE.—The fuselage has a somewhat elliptical cross-section and has a straight ventral line, sweeping upwards towards the tail position.

TAIL UNIT.—Cantilever swept tailplane with sharp dihedral. Swept fin and broad chord single rudder.

LANDING GEAR.—"Bicycle" main wheels housed fore and aft of the bomb bay. Outrigger supporting wheels are housed in the wing-tip fairings.

POWER PLANT.—Four turbojet engines possibly of the M-209 or a related type. Intakes are slightly elliptical and the nacelles are canted so that exhausts are deflected from the fuselage, and staggered to ensure air supply for the inboard engines. Power of engines is in region of 8,200-9,300 kg. (18,040-20,460 lb.) s.t. each at sea level.

ACCOMMODATION.—Crew of eight or more. Glazed position in nose, three observation domes and a manned tail position.

ARMAMENT.—Forward dorsal and ventral turrets and tail turret. These are thought to be equipped with 23 mm. guns, two in each. Bomb load (normal) estimated at



Two "Bison" Four-jet Heavy Bombers flying over Tushino in June, 1956.

4,500 kg. (9,900 lb.). Maximum load may be 9,000 kg. (19,800 lb.). The bomb-bay about 6 m. (19.68 ft.) long.

EQUIPMENT.—Radome under nose and plentiful radio and radar aerials, though probably of somewhat obsolescent design and badly positioned. Tail gunner's position appears to have radar warning.

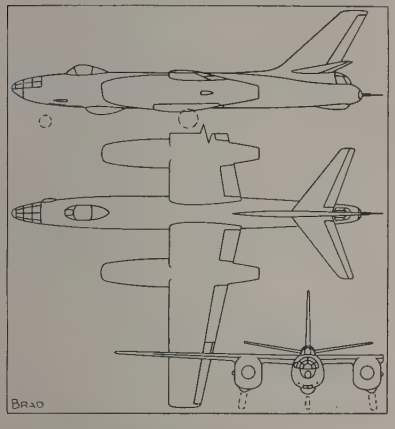
DIMENSIONS (approx.).—
Span 52 m. (170 ft. 7 in.).
Length 49.5 m. (162 ft. 5 in.).
Wing area 340 m.² (3,660 sq. ft.).

WEIGHTS.—
Loaded weight 165,600 kg. (365,110 lb.).

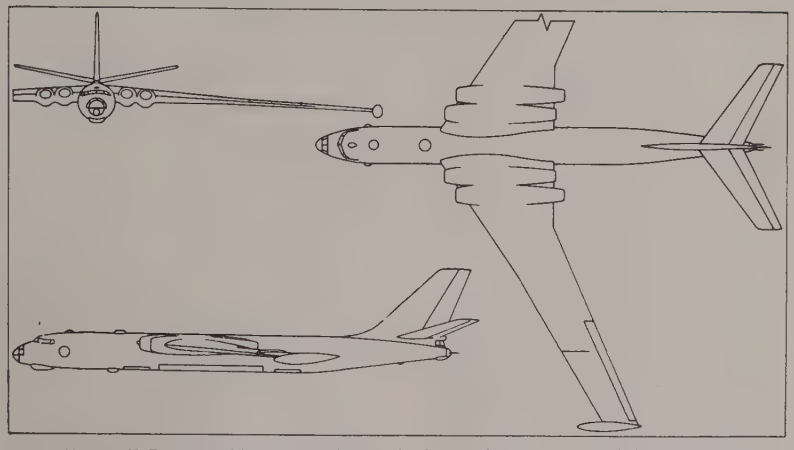
PERFORMANCE.—
Max. speed 900 km.h. (559 m.p.h.).
Range 11,450 km. (7,100 miles).

THE IL-28.
NATO Code Name: "Beagle."

The Il-28 appeared in numbers over Moscow on May Day, 1950, and several versions are now in service with Soviet Air Force units in all parts of the U.S.S.R.



The Ilyushin Il-28.



The "Bison" Four-jet Heavy Bomber, which is believed to be of Ilyushin design.

The Il-28 has been delivered abroad, first to the Polish Air Force in 1953. It has also been supplied to Czechoslovakia, where it is now being built in one of the state factories. Among more recent deliveries are a small number of Il-28's and Il-28-U's to Rumania in 1955 and some 50 to the Egyptian Air Force in 1955-56. The latter were built in and supplied by Czechoslovakia.

TYPE.—Twin-jet Light Attack Bomber.

WINGS.—Shoulder-wing cantilever monoplane with straight leading-edge and swept-forward trailing-edge.

FUSELAGE.—Circular-section all-metal structure.

TAIL UNIT.—Swept-back surfaces, tailplane dihedral.

LANDING GEAR.—Main wheels retract forward and lie flat in nacelles. Double nose-wheel.

POWER PLANT.—Two VK-1 centrifugal-flow turbojet engines. Fuel capacity 11,900 litres (2,620 gallons) with provision for additional fuel in wing-tip tanks.

ACCOMMODATION.—Raised pilot's cockpit, glazed nose position with optically flat panel. Tail gunner's position under rudder, with power-operated entry hatch in bottom of fuselage.

ARMAMENT AND EQUIPMENT.—Two fixed forward-firing automatic aircraft guns in lower part of nose, thought to be 23 mm. NS type with 150 r.p.g. Two 23 mm. guns in tail turret. Bomb loads believed to total up to maximum 3,000 kg. (6,600 lb.). Bombsight is thought to be German-



The Ilyushin Il-28 Light Attack Bomber (two VK-1 turbojet engines).



The Ilyushin Il-20, the de-militarised version of the Il-28, in service with Aeroflot as a high-speed specialised cargo carrier.

designed synchronus optical type with a ceiling of 15,000 m. (49,200 ft.) Radar equipment for navigation and blind bombing in scanner radome below forward fuselage. Radio equipment probably includes an RS1-6 transmitter/receiver and an RSB-*bis* for transmission and reception on broader frequency ranges. In later versions VHF equipment may replace the RS1-6. An IFF set and radio compass or RDF are provided.

DIMENSIONS (approx.).—
Span 20.75 m. (68 ft.).
Length 18.9 m. (62 ft.).

PERFORMANCE (estimated).—
Max. speed 935 km.h. (580 m.p.h.) up to 6,000 m. (19,680 ft.).
Cruising speed 725 km.h. (450 m.p.h.) at 10,000-12,000 m. (32,800-39,360 ft.).
Rate of climb 900 m./min. (2,950 ft./min.) at 3,000 m. (9,840 ft.).
Range (with max. bomb load) 2,400-2,500 km. (1,490-1,550 miles).

THE IL-28U TRAINER.
NATO Code Name: "Mascot."

In 1951 there appeared a trainer version of the Il-28 bomber. This differs from the operational version in having a stepped-down tandem cockpit arrangement and lacks the radome. Generally it does not carry all the armament of the standard bomber version.

The Il-28U is in service with the Soviet Air Fleet and also in Czechoslovakia and Rumania.

The general performance of this version is thought to be similar to that of the Il-28, although the range is likely to be greater.

THE IL-20.

The Il-20, which is a demilitarised version of the Il-28, was introduced into Aeroflot service early in 1955 for the high-speed transport of light non-bulky freight of an important character, such as newspaper matrices, etc. Few modifications appear to have been made to adapt the aircraft to its civil rôle, beyond the removal of the armament and special operational equipment. The gun ports remain and there are few external differences between the two aircraft. A crew of three is carried.

Powered by two VK-1 turbojets (each 2,700 kg. = 5,955 lb. s.t.), the Il-20 has a range of approximately 2,400 km. (1,500 miles) at over 800 km.h. (500 m.p.h.).

THE IL-18 MOSKVA (MOSCOW).

The Il-18 Moskva is a large passenger transport aircraft powered by four 4,000 h.p. Kuznetsov NK-4 turboprop engines. It had made three flights prior to its first public appearance at a Moscow airport in July, 1957, and is intended largely for use on internal services.

This Il-18 should not be confused with the transport described under that designation in the 1951-1952 edition of "All the World's Aircraft."

More than one version of the Il-18 is contemplated; and freight, first-class (74 passenger) and tourist (100 passenger) variants may be built. Passengers are accommodated in five pressurised compartments, and there are facilities for providing hot meals.

The cruising speed is 650 km./hr. (405 m.p.h.) and the range is more than 4,800 km. (2,980 miles).

THE IL-14.
NATO Code Name: "Crate."

The Il-14 differs externally from the Il-12 mainly in having a revised tail configuration, blunter wing-tips and some thrust augmentation similar to that employed in the Convair-Liner.

There are two main versions, as follows :—

Il-14P. Standard civilian version accommodating 18 passengers. Also in production at the Georgi Dimitrov works at Letnany, Prague, Czechoslovakia, where it is known as the Avia-14, and in East Germany. Descriptions of these licence-built versions appear in the Czech and East German sections of this work.

Il-14M. Developed version with lengthened fuselage, capable of accommodating 24 passengers.

The Polish airline LOT has some Il-14's and some military examples were supplied to the Egyptian Air Force early in 1956.

Il-14's have been presented for the personal use of the heads of state of many Asian and African countries, including India, Burma, Afghanistan, Indonesia, Iran, Egypt, and possibly the Yemen.

TYPE.—Twin-engined Transport.
CONSTRUCTION.—Similar to Il-12
POWER PLANT.—Two ASh-82T fourteen-cylinder radial air-cooled engines, each rated at 1,900 h.p. at 2,600 r.p.m. for take-off and driving four-blade AV-50 metal airscrews of 3.80 m. (12 ft. 6 in.) diameter. Fuel load 2,215 kg. (4,883 lb.).
ACCOMMODATION (Il-14P).—Crew of five. Standard seating for 18 passengers. Rear starboard passenger door.
ACCOMMODATION (Il-14M).—Standard seating for 24 passengers.
DIMENSIONS (Il-14P).—
Span 31.70 m. (104 ft.).
Length 21.31 m. (69 ft. 11 in.).
Height 7.80 m. (25 ft. 7 in.).



The Il-18 Moskva Airliner (four 4,000 h.p. Kuznetsov NK-4 turboprop engines).



The Ilyushin Il-14 Airliner (two 1,900 h.p. ASh-82T engines).

DIMENSIONS (Il-14M).—
Same as Il-14P except :—
Length 22.31 m. (73 ft. 3½ in.).
WEIGHTS (Il-14P).—
Weight empty 12,080 kg. (26,630 lb.).
Weight loaded 16,500 kg. (36,380 lb.).
WEIGHTS (Il-14M).—
Weight empty 12,250 kg. (27,000 lb.).
Weight loaded 17,250 kg. (38,030 lb.).
PERFORMANCE (Il-14P).—
Max. speed at S/L 396 km.h. (246 m.p.h.).
Max. speed at 2,400 m. (7,875 ft.) 430 km.h. (267 m.p.h.).
Cruising speed at 3,000 m. (9,850 ft.) 320 km.h. (199 m.p.h.).
Landing speed 135 km.h. (84 m.p.h.).
Rate of climb at S/L 318 m./min. (1,045 ft./min.).
Service ceiling 7,000 m. (23,000 ft.).
Range at 320 km.h. (199 m.p.h.) at 3,000 m. (9,850 ft.) 1,900 km. (1,180 miles).
Range at 260 km.h. (162 m.p.h.) at 3,000 m. (9,850 ft.) 3,200 km. (1,990 miles).
PERFORMANCE (Il-14M).—
Max. speed at S/L 382 km.h. (237 m.p.h.).
Max. speed at 2,400 m. (7,875 ft.) 416 km.h. (258 m.p.h.).
Max. cruising speed at 2,500 m. (8,200 ft.) 358 km.h. (222 m.p.h.).
Landing speed 135 km.h. (84 m.p.h.).
Rate of climb at S/L 288 m./min. (945 ft./min.).
Range 1,500 km. (930 miles).

THE IL-12.

NATO Code Name: "Coach."

The Il-12, which first flew in 1946, is still the standard medium-range airliner used by Aeroflot. The Il-12 is also in service with C.S.A. (Czechoslovak Airlines) and L.O.T. (Polish Airlines).

TYPE.—Twin-engined Transport.

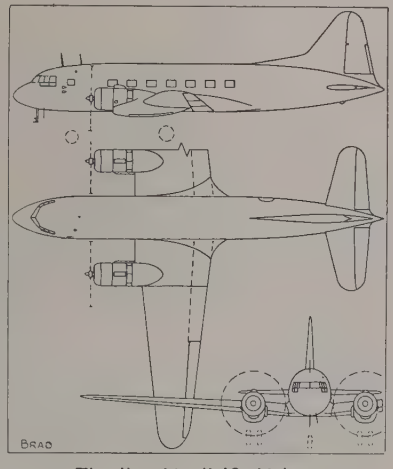
WINGS.—Low-wing cantilever monoplane. Two spar metal structure, with metal stressed skin covering. Ailerons in outer panels, with trim tab in starboard aileron only. Split trailing-edge flaps, divided into two at junction of outer panels and centre section. Wing de-icing by warm air ducted through oil coolers and thence to leading-edges. Wing area 100 m.² (1,076 sq. ft.).

FUSELAGE.—Oval all-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. May be seen with or without dorsal fin extension. Metal-clad fixed surfaces, control surfaces metal-framed, fabric-covered. Spring tab in rudder and elevators. Tailplane de-icing as for wings.

LANDING GEAR.—Retractable tricycle type. Single nose-wheel retracts rearwards into fuselage. Main wheel units, each with twin wheels, retract forward into engine nacelles. Detachable tail strut used during loading operations.

POWER PLANT.—Two ASh-82FNV fourteen-cylinder two-row radial air-cooled engines developing 1,775 h.p. for take-off at 2,400 r.p.m. Rated power 1,600 h.p. at 2,050 m. (6,730 ft.) and 1,350 h.p. at 5,540 m. (17,720 ft.). Four-blade metal constant-speed fully-feathering airscrews. Total fuel capacity 3,500 litres (1,435 Imp. gallons) in eight tanks, two in fuselage, two in centre section, two in each outer wing section.



The Ilyushin Il-12 Airliner.

ACCOMMODATION.—Crew of five, comprising pilot and co-pilot side-by-side, navigator and radio-operator on flight deck to rear of pilots, and stewardess. Accommodation for 27-32 passengers in air-conditioned main cabin. Standard version seats 27 in a row of nine single seats down the starboard side of cabin, and nine double seats down port side. Toilet compartment at rear.

EQUIPMENT.—Night and blind-flying equipment, two-way V.H.F. and full radio installations.

DIMENSIONS.—
Span 31.7 m. (104 ft.).
Length 21.31 m. (69 ft. 10¾ in.).
Height 8.07 m. (26 ft. 6 in.).

WEIGHTS AND LOADINGS (27-passenger version).—
Empty weight 9,000 kg. (19,850 lb.).
Payload 3,000 kg. (6,610 lb.).
Loaded weight 17,250 kg. (38,000 lb.).
Take-off power loading 4.76 kg./h.p. (10.7 lb./h.p.).

PERFORMANCE.—
Max. speed 365 km.h. (226 m.p.h.) at sea level.
370 km.h. (230 m.p.h.) at 500 m. (1,640 ft.).
385 km.h. (239 m.p.h.) at 1,000 m. (3,280 ft.).
407 km.h. (252 m.p.h.) at 2,500 m. (8,220 ft.).
Cruising speeds 325 km.h. (202 m.p.h.) at sea level.
335 km.h. (208 m.p.h.) at 1,000 m. (3,280 ft.).
350 km.h. (217 m.p.h.) at 2,500 m. (8,220 ft.).
345 km.h. (214 m.p.h.) at 3,000 m. (9,840 ft.).
Landing speed 145 km.h. (90 m.p.h.).
Take-off run 360 m.-520 m. (1,185 ft.-1,705 ft.).
Landing run 450 m. (1,475 ft.).
Single-engine ceiling 3,000 m. (9,840 ft.).
Range with 32 passengers 20 kg. (45 lb.) baggage each 1,250 km. (777 miles).
Range with 27 passengers 20 kg. (45 lb.) baggage each 2,000 km. (1,240 miles).
Range with 16 passengers (de luxe version) 3,000 km. (1,865 miles).



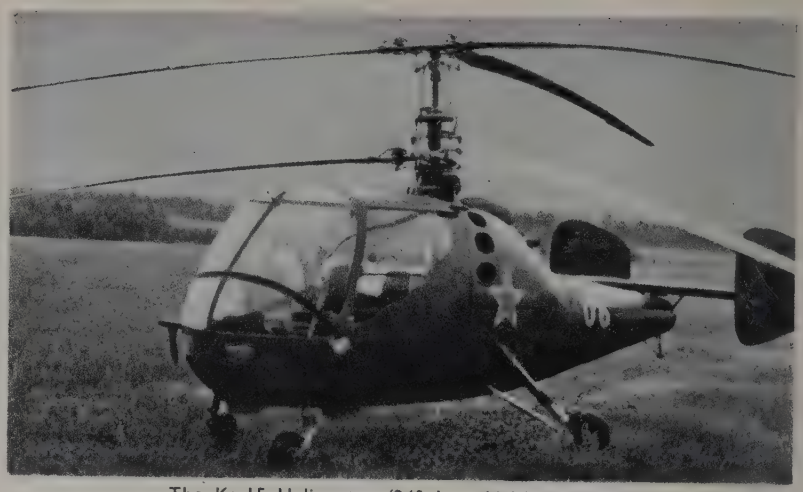
The Ilyushin Il-12 Airliner (two 1,775 h.p. ASh-82FNV engines).

KAMOV

NIKOLAI I. KAMOV.

N. I. Kamov is a well-known figure in the development of the Soviet Union's rotary-wing aeroplanes. He was active from the late 1920's until the beginning of World War II, and shortly after 1945 began to investigate the possibility of producing a lightweight helicopter of the "flying motor-cycle" type.

One of the first studies was the Ka-8, described in the 1951-52 edition of this Annual (under the designation K-17), though it was rather under-powered and was not a great success. It was developed into the Ka-10, of which twelve examples were built and tested during 1950. A later modification was the Ka-10M with twin fins and rudders, and in recent years Kamov and his design team, under chief engineer Vladimir Barshevskii, have built the two-seat Ka-15 and the Ka-18.



The Ka-15 Helicopter (240 h.p. AI-14R engine).

THE KA-10.

TYPE.—Single-seat Light Utility helicopter.
ROTORS.—Two contra-rotating three-blade rotors of laminated wood and plastic, fully articulated in flapping and drag planes.
FUSELAGE.—Simple tubular framework, carrying engine, rotor supports, seat, and attachments for tail unit.
TAIL UNIT.—Single angular vertical stabilising surface.
LANDING GEAR.—Twin pontoons.
POWER UNIT.—One AI-4G engine giving 55 h.p. at 4,500 r.p.m.
ACCOMMODATION.—Single open seat behind engine.
DIMENSIONS.—
Rotor diameter 6.13 m. (20 ft. 1 in.).
Length 3.9 m. (12 ft. 9½ in.).
Width 1.97 m. (6 ft. 5½ in.).
Height 2.5 m. (8 ft. 2½ in.).
WEIGHT.—
Weight loaded 375 kg. (827 lb.).
PERFORMANCE.—
Max. speed 116 km.h. (72 m.p.h.).
Hovering ceiling 300 m. (985 ft.).
Absolute ceiling 2,500 m. (8,200 ft.).
Range 195 km. (120 miles).
Max. endurance 2 hrs.

THE KA-10M.

The Ka-10M is a slightly modified version of the Ka-10. The chief difference is that the single fin of the latter has been replaced by twin, rounded vertical stablising surfaces.

THE KA-15.

The Ka-15 was reported in 1956. It is a two-seat helicopter, developed with the aid of experience gained with earlier designs, and more powerful than the Ka-10 and Ka-10M.
TYPE.—Light Utility helicopter.
ROTORS.—Two contra-rotating three-blade rotors, similar to those of the Ka-10M, of wood and plastic construction. Plywood covering.
FUSELAGE.—Metal frame with plywood covering, stressed skin at rear. Large transparent nose portion.
TAIL UNIT.—Tailplane above fuselage decking, with two end-plate vertical fins.
LANDING GEAR.—Four-wheel forward unit. Small tail bumper.
POWER PLANT.—One 240 h.p. AI-14R nine-cylinder radial engine, with single-speed supercharger and cooling fan.
ACCOMMODATION.—Two side-by-side seats.
PERFORMANCE.—
Cruising speed 120 km.h. (75 m.p.h.).
Hovering ceiling 680 m. (2,230 ft.).
Service ceiling 3,000 m. (9,840 ft.).

THE KA-18.

The Kamov Ka-18 is a four-seater development of the Ka-15. It first flew in mid-1957 and is now in series production. It will be used for a variety of rôles, including civil communications and air ambulance duties.

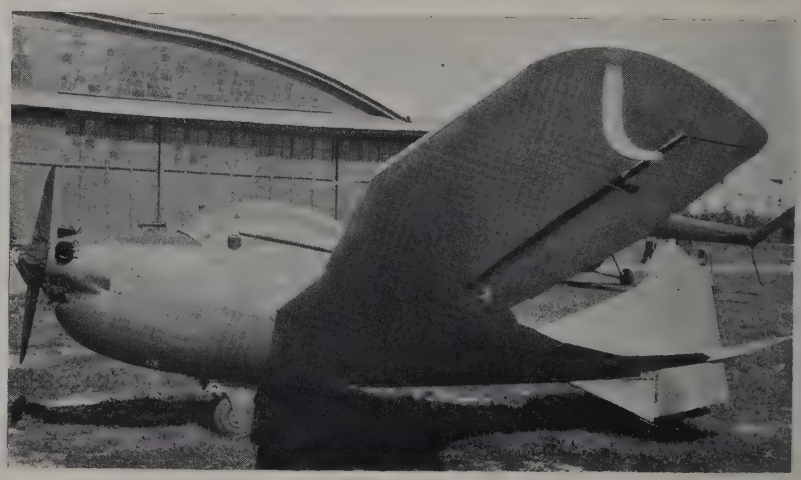
KUZAKOV

M. A. KUZAKOV.

M. A. Kuzakov is a glider designer, who has been studying "all-wing" designs since the 1930's. In 1956 there was reported a motorised version of the MAK-15 training glider.

THE MAK-15MP.

TYPE.—Light powered glider for aerobatic and training use.
WINGS.—Gull-wing type, of wood and fabric construction. Joined by broad fillets to the tailplane.
FUSELAGE.—A "pod" houses the motor and the pilot. A relatively small rear section connects with the tail unit.
TAIL UNIT.—Tailplane integral with wing roots. Triangular fin and large rudder.
LANDING GEAR.—Single wheel under fuselage, skids at wing-tips.
POWER PLANT.—One 25 h.p. Polyakov five-cylinder radial two-stroke engine.
ACCOMMODATION.—One seat under a large transparent moulded canopy.
WEIGHTS.—
Weight loaded 311 kg. (685 lb.).
PERFORMANCE.—
Max. speed 150 km.h. (93 m.p.h.).



The Kuzakov MAK-15MP Powered Glider (25 h.p. Polyakov engine).

MIG

ARTEM MIKOYAN AND MIKHAIL GUREVICH.

Mikoyan and Gurevich, a mathematician, have collaborated for many years in the design of high-performance fighter aircraft. They were responsible for the MiG-9 of 1946, one of the first all-Russian jet fighters to go into service in Soviet squadrons. The MiG-9 is now obsolete.

The modern trend of Russian fighter design was first typified by the MiG-15, which proved itself in action in Korea.

The production MiG-15 began to appear in squadron service in numbers in 1949, and by 1952 it was flying in many satellite air forces. Many hundreds—probably some thousands—of MiG-15's have been made available for their use.

The MiG-17, a progressive development of the MiG-15, appeared in Soviet squadrons in 1953 or 1954, and this has been followed by the supersonic MiG-19 which appeared in 1955.

THE MIG-19.

NATO Code Name: "Farmer."

The MiG-19 was first publicly seen in a formation of 48 in the 1955 Soviet Aviation Day Display at Tushino. The data given below are in most cases estimates.

TYPE.—Single-seat Interceptor Fighter.
WINGS.—Cantilever monoplane with slight anhedral and swept at 45° at 25% of chord. Single fence on each wing at mid-span.
FUSELAGE.—Circular section with straight top line and slightly curved ventral line. Air intake in nose and twin jet exits under rudder.
TAIL UNIT.—Swept horizontal and vertical surfaces.
LANDING GEAR.—Tricycle type with inward-retracting main wheels.
POWER PLANT.—Two axial-flow turbojets of unknown type, with reported thrust of 4,000 kg. (8,818 lb.) each.
ACCOMMODATION.—Single cockpit well forward above nose.
ARMAMENT.—No reliable information, but probably 2-3 cannon.
DIMENSIONS.—
Span 9.75 m. (32 ft.).
Length 11.43 m. (37 ft. 6 in.).
WEIGHT.—
Weight loaded 9,000 kg. (19,840 lb.).
PERFORMANCE.—
Max. level speed reported as Mach 1.4.

THE MIG-17.

NATO Code Name: "Fresco A, B, C and D".

The MiG-17 appeared in 1953 or 1954 and is a development of the MiG-15. Externally it differs by having a slightly slimmer fuselage, rounded tips to more sharply-swept wings, and alterations to the tail unit.

Four versions of the MiG-17 have been distinguished. They are :—

"Fresco A." Rear fuselage dive brakes.

"Fresco B." Dive brakes forward, near wing trailing-edge.

"Fresco C." Similar to "A" ; engine equipped with afterburner.

"Fresco D." Radar-equipped all-weather fighter, with slight nose modifications. Dive brakes are at rear fuselage.

TYPE.—Single-seat Interceptor Fighter.

WINGS.—Mid-wing all-metal cantilever monoplane. General sweepback 45° 30′. The centre-section leading-edge is more sharply swept than the outer panels. There are three boundary-layer fences on each wing, though early examples had two only.

FUSELAGE.—Generally similar to that of the MiG-15. The rear air brakes are bulged and break the surface of the fuselage.

TAIL UNIT.—Sharply-swept surfaces, the rudder and fin being of higher aspect ratio than those of the MiG-15. Vertical surfaces faired into tailpipe whereas the rudder overhangs this in the MiG-15.

LANDING GEAR.—Standard tricycle nose-wheel type.

POWER PLANT.—One Klimov VK-2 (?) centrifugal-flow gas turbine of some 3,450 kg. (7,590 lb.) static thrust (with afterburning ?). Normal fuel load in internal tanks 1,650 litres. Large external tanks may be fitted at half-span on each wing.

ACCOMMODATION.—Single pressurised cockpit.

ARMAMENT.—One 37 mm. Nudelmann cannon and two 23 mm. cannon said to be of NR type. The N gun may have a 15% higher rate of fire than that of the MiG-15. A single 23 mm. gun package may be installed in some instances at the wing tank position, to supplement the standard fuselage guns. Rocket projectiles also form part of the armament.

EQUIPMENT.—RS I-6K radio transmitter ; RS I-6M-1 receiver ; IFF transponder ; radio compass ; radio altimeter ; and marker beacon receiver.

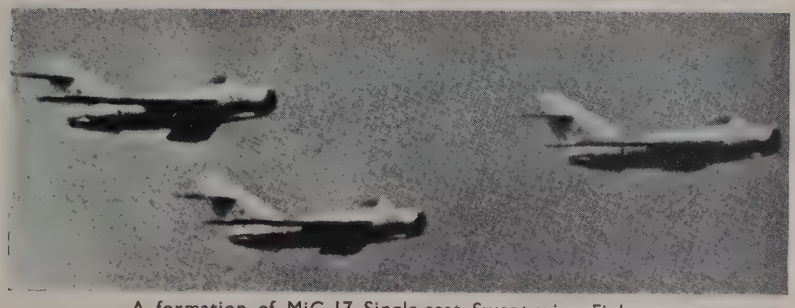
DIMENSIONS (approx.).—
Span 10.96 m. (36 ft.).
Length 10.74 m. (35 ft. 3 in.).
Wing area 25.8 m.² (277.6 sq. ft.).

WEIGHTS.—
Empty weight 4,470 kg. (9,850 lb.).
Weight at take-off 5,900 kg. (13,000 lb.).

PERFORMANCE (approx.).—
Max. speed 1,175 km.h. (730 m.p.h.).
Landing speed 211 km.h. (127 m.p.h.).
Rate of climb 3,200 m./min. (10,500 ft./min.).
Service ceiling 17,400 m. (57,100 ft.).
Endurance 1 hr. 55 min.



A formation of MiG-19 Single-seat Swept-wing Fighters.



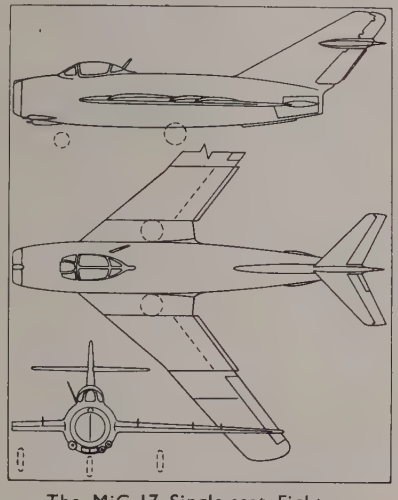
A formation of MiG-17 Single-seat Swept-wing Fighters.

THE MIG-15.

NATO Code Name: "Fagot."

TYPE.—Single-seat Jet Fighter.

WINGS.—Mid-wing cantilever monoplane. Sweepback at leading-edge 42°. Dihedral −3°. Thickness/chord ratio 11 per cent constant. All-metal light alloy stressed-skin structure with two main I-section spars. The straight rear spar, which takes all main wing loads, is attached to a heavy steel and aluminium fuselage frame. The front spar is cranked forward from the landing gear attachment point to serve as front wall of wheel-well, and is attached to another strong fuselage frame. A third short spar member, originating just outboard of the landing-gear hinge point, runs at right angles to the fuselage centre-line and transmits wing bending loads. Hydraulically-operated Fowler split flaps. Ailerons have both mass and sealed aerodynamic balances. Two stall fences on each wing. Gross wing area 23.7 m.² (255 sq. ft.).



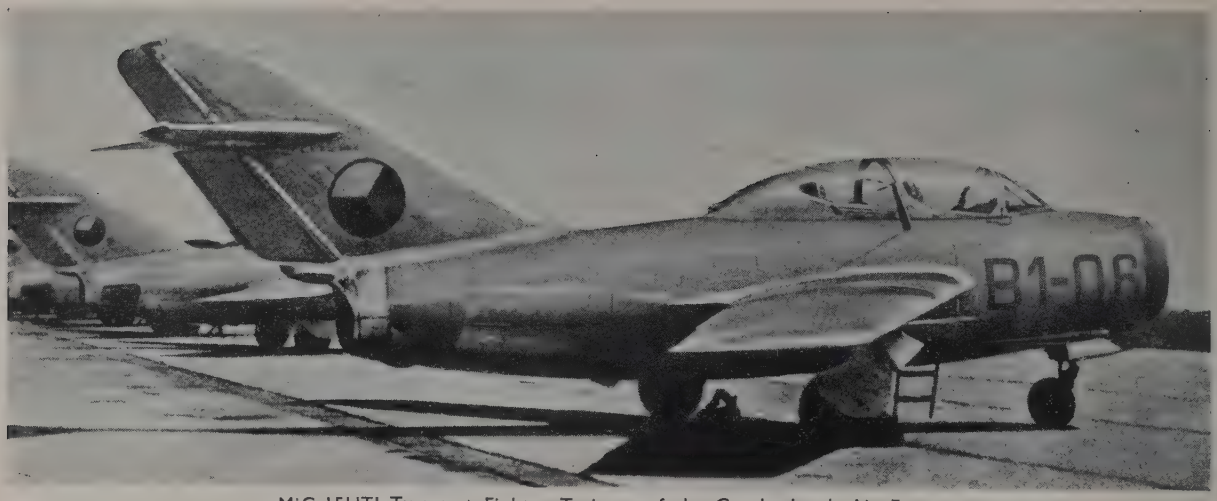
The MiG-17 Single-seat Fighter.

FUSELAGE.—Semi-monocoque light alloy stressed-skin structure. In two main units, a forward assembly of nose and mid sections, and a rear section, joined by quick-release bolts at the rear wing spar attachment points ; the rear fuselage being easily detachable for engine servicing. Air brakes on rear fuselage.

TAIL UNIT.—Cantilever monoplane type. Sweepback on fin and tailplane leading-edges 42°. Thickness/chord ratio on all surfaces 8 per cent. Tailplane, high up fin, has single steel spar and light alloy frames and skin. The large fin has two spars, the rear spar of steel and the other spar, frames and skin of light alloy. Fin rear spar, which takes main flight loads, attached to heavy steel fuselage frame surrounding jet orifice. Tailplane incidence adjustable on ground only. Elevators and rudders of



The MiG-15 Single-seat Fighter (RD-45 turbojet engine).



MiG-15UTI Two-seat Fighter Trainers of the Czechoslovak Air Force.

stressed light alloy construction. Electrically-operated trim-tab in port elevator. Both upper and lower rudders mass-balanced. Tailplane span 4.5 m. (14 ft. 10 in.).

LANDING GEAR.—Retractable tricycle. Air-oil shock absorbers. Main wheels, with levered suspension, raised inward, nose wheel forward. Hydraulic retraction, with emergency pneumatic system. Hydraulic brakes.

POWER PLANT.—One RD-45 centrifugal-flow turbojet engine (2,740 kg.=5,450 lb. s.t.). Bifurcated nose air-inlet. Fuel tanks in mid fuselage section between the divided air intake ducts. Total internal fuel capacity 1,250 litres (330 U.S. gallons). Drop tanks 600 litres (160 U.S. gallons) each may be carried, one under each wing.

ACCOMMODATION.—Pressurised cockpit forward of wing leading-edge with sliding canopy. Max. pressure 4.2 lb./sq. in. from 26,000 ft. (7,930 m.) up. Oxygen system is provided for emergency use. Ejection seat with automatic release, not fitted in early examples, is now standard.

ARMAMENT.—Standard armament consists of two NS (Nudelmann-Suranov) 23 mm. cannon below port side of nose and one 37 mm. N (Nudelmann) cannon below starboard side. Guns mounted in a carriage which can be lowered for easy maintenance when a panel is removed. Gyro gun-sight. Rockets or two 1,000 bombs may be carried under wings. Earlier MiG-15's had two 12.7 mm. machine-guns and one 37 mm. cannon. Other armament combinations have been fitted to some examples, including trials of a 45 mm. cannon and an all machine-gun installation.

DIMENSIONS.—
Span 10.10 m. (33 ft. 1½ in.).
Length 11.10 m. (36 ft. 4 in.).
Height 3.40 m. (11 ft. 2 in.).

WEIGHTS.—
Weight empty 3,780 kg. (8,320 lb.).
Weight loaded (combat) 5,120 kg. (11,270 lb.).
Max. loaded weight (with external fuel or bombs) 6,465 kg. (14,240 lb.).

PERFORMANCE.—
Max. speed approx. 1.072 km.h. (670 m.p.h.).
Stalling speed 175 km.h. (109 m.p.h.).
Initial rate of climb 3,170 m./min. (10,400 ft./min.).
Service ceiling 15,550 m. (51,000 ft.).

THE MIG-15*bis*.

TYPE.—Single-seat Jet Fighter.

CONSTRUCTION.—As for standard MiG-15, but wings of MiG-15*bis* have perforated flaps.

POWER PLANT.—One VK-1 centrifugal-flow turbojet engine (2,700 kg.=5,955 lb. s.t.).

FUEL.—T-77 kerosene. Internal capacity 1,410 litres (310.2 Imp. gallons) external fuel 490 litres (108 Imp. gallons).

ACCOMMODATION.—Pilot's seat below rear-sliding canopy.

ARMAMENT AND EQUIPMENT.—One 37 mm. cannon with 40 rounds on starboard side of lower ront fuselage: two 23 mm. NS cannon each with 80 rounds on port side. Gyro gun sight. Attachments for auxiliary fuel tanks.

DIMENSIONS.—
Span 10.1 m. (33 ft. 1⅛ in.).
Length 11.1 m. (36 ft. 4 in.).
Wing area 17.25 m.² (186.7 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight loaded 5,028 kg. (11,085 lb.).

PERFORMANCE.—
Max. speed between 1,100-1,200 km./hr. (684-746 m./hr.).
Stalling speed (clean) 210 km./hr. (131 m.p.h.).
Stalling speed (flap and L/G down) 190 km./hr. (118 m.p.h.).
Ceiling above 15,000 metres (49,200 ft.).
Endurance about 2 hours.

THE MIG-15UTI.
NATO Code Name: "Midget."

TYPE.—Two-seat conversion trainer developed from MiG-15.

CONSTRUCTION.—Similar to fighter type.

POWER PLANT.—One RD-45 centrifugal-flow turbine developed from Nene.

ACCOMMODATION.—Pupil and instructor sit in tandem under long raised canopy.

ARMAMENT.—Guns not carried but fairings are retained.

DIMENSIONS.—
Span 10.10 m (33 ft. 1½ in.).
Length 11.10 m. (36 ft. 4 in.).

PERFORMANCE.—
Similar to that of MIG-15.

MIL

MIKHAIL L. MIL.

M. L. Mil is a well-known worker in the field of rotating-wing aeroplanes. He has been connected with Soviet gyroplane and helicopter development since at least 1930, and in the thirties was collaborating with V. A. Kuznetsov and N. K. Skrzhinskii. His latest designs are influenced by the work of Boris N. Yurev, who directs much of the helicopter research in the U.S.S.R.

The Mi-1, which was designed in 1949, first flown in 1950 and was introduced into squadron service in 1951, was followed in 1953 by the appearance of the Mi-4 in a number of variants. The latter type now seems to be the more widely used, both by Aeroflot and the Services.

The Mi-1 has been placed in production in Poland, under the designation SM-1.

Between April 25 and 29, 1955, three World records were claimed by pilots of the Mi-4. Kaprelyan took a load of 2,000 kg. (4,400 lb.) to 6,017.5 m. (19,737 ft.); Vinitskii took 1,000 kg. (2,200 lb.) to 6,048 m. (19,838 ft.); and Kaprelyan and Tsemskov flew over a 500 km. (310 miles) closed circuit at an average speed of 187.254 km.h. (116.28 m.p.h.).

THE MI-1.
NATO Code Name: "Hare."

There are three versions of this helicopter:—

Mi-1. Accommodation for pilot and three passengers.

Mi-1T. Accommodation for pilot and two passengers. Can be distinguished by two small horizontal stabilisers at rear of main tail-boom.

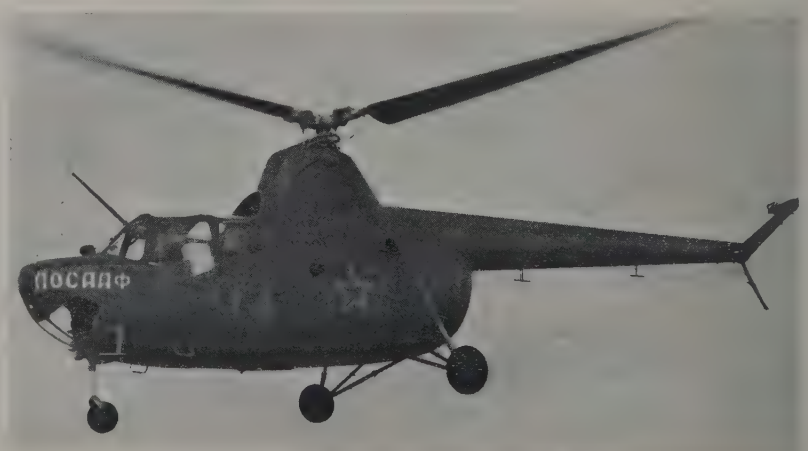
Mi-1NKh. Multi-purpose version, suitable for postal, ambulance and agricultural duties. NKh is an abbreviation of Narodno-Khozyaistvennyi (national economic). In series production.

TYPE.—Single-rotor General Purpose Helicopter.

ROTORS.—The three main blades are of mixed construction and are movable axially and horizontally. Change in the angle of incidence is effected by tilting the main rotor spider. The three-blade anti-torque rotor is driven by a shaft running through the rear fuselage boom.

FUSELAGE.—The main fuselage is a tubular-steel structure with skin covering. The tail boom is a semi-monocoque structure with ring frames and longerons.

LANDING GEAR.—Fixed tricycle type with steerable nosewheel. Brakes on main wheels.



The Mi-1 Helicopter (575 h.p. Al-26B engine).

POWER PLANT.—One 575 h.p. AI-26B seven-cylinder fan-cooled radial engine with horizontal crankshaft. Inclined gearbox drives shaft to main rotor and also to tail anti-torque rotor. Rotor brake fitted. The main fuel tank is at the rear of the aft engine firewall.

ACCOMMODATION.—Pilot's seat forward; bench for two (Mi-1T) or three (Mi-1) passengers at rear. Car-type door on each side.

EQUIPMENT.—Transmitter/receiver radio is in extreme front of nose. Radio altimeter and inverter are at rear of main fuselage and dipole aerials under the tail boom. Full night-flying equipment.

DIMENSIONS.—
Main rotor diameter 14.0 m. (45 ft. 11 in.).
Fuselage length 12.10 m. (39 ft. 8 in.).
Tail rotor diameter 2.5 m. (8 ft. 3 in.).
Overall height 3.3 m. (10 ft. 10 in.).

WEIGHTS.—
Weight empty 1,785 kg. (3,925 lb.).
Max. loaded weight 2,250 kg. (4,960 lb.).

PERFORMANCE (Polish-built SM-1).—
Max. forward speed 185 km.h. (115 m.p.h.).
Max. rate of climb 390 m./min. (1,280 ft./min.).
Time to 1,000 m. (3,280 ft.) 4 min.
Time to 3,000 m. (9,840 ft.) 12 min.
Hovering ceiling 3,000 m. (9,840 ft.).
Max. range 385 km. (240 miles).
Max. endurance 3 hr. 24 min.

THE MI-1U.

At least one Mi-1 has been modified to have dual controls, to enable conversion training to be carried out. It is designated Mi-1U.

THE MI-3.

The Mi-3 has been derived by improvement of the Mi-1 helicopter, with which it is externally almost identical. However, the three-blade rotor of the early type has now been replaced by an aerodynamically more efficient four-blade rotor, and the fuselage has been slightly modified. The Mi-3 is fitted with two external blisters for downward visibility, and can be equipped with up to three external containers for casualties, freight, fuel, or agricultural chemicals.

A radio compass has now been installed, and UKF ultra short wave radio is carried. Some of the new navigational equipment is housed in a small blister under the tail-boom.

DIMENSIONS.—
Rotor diameter 14.3 m. (46 ft. 11 in.).
Fuselage length 12.1 m. (39 ft. 9 in.).

WEIGHTS.—
Weight empty 1,800 kg. (3,968 lb.).
Weight loaded 2,350 kg. (5,180 lb.).



The Mi-4S Agricultural Helicopter (1,700 h.p. ASh-82V engine).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Hovering ceiling 2,000 m. (6,561 ft.).
Absolute ceiling 4,500 m. (14,765 ft.).

THE MI-4.

NATO Code Name: "Hound."

The data given below for this helicopter are thought to be reliable. A number of small variations in positioning of air intakes and design of landing gear struts may be found. The Mi-4 is used on many different duties in all parts of the Soviet Union, and the following variants have been identified.

Mi-4. Basic military version.

Mi-4P. Passenger-carrying version in service with Aerofiot. Has comfortably-furnished cabin for 10 passengers and space for luggage to make up normal payload of 1,000 kg. (2,200 lb.). Externally, the Mi-4P can be distinguished by spatted wheels, square cabin windows and deletion of ventral container.

Mi-4S. Agricultural version. The ventral container can be used as a distribution point for sprays or dusts, and spray booms are fitted underneath the rotor. Maximum load is 1,000 kg. (2,200 lb.) of dust or insecticide or 1,500 litres (330 Imp. gallons) of spray liquid, contained in a fuselage tank.

In addition, a fire-fighting development of the Mi-4 has been flown. It is probably closely related to the Mi-4S. An orientatable spray nozzle in the ventral "bath" container can direct extinguisher fluid at a fire, the supply being maintained by an electric pump.

An Mi-4 was specially modified for a number of international helicopter record flights. These included a height record of 6,048 m. (19,843 ft.) on April 26, 1956. It was lightened by removing the ventral container and some of the external air scoops, by using smaller main wheels and by replacing the metal rear doors with fabric-covered doors.

The following data apply to the standard Mi-4.

TYPE.—Single-rotor General Purpose Helicopter.

ROTORS.—Four-bladed main rotor, and three-bladed anti-torque rotor at starboard side of tail boom.

FUSELAGE.—Motor mounted in extreme nose leaves rear available for freight or passengers. Access for bulky loads is through "clam-shell" doors under the tail boom attachment point.

UNDERCARRIAGE.—Two main wheels braced to fuselage sides, and two small nosewheels forward.

POWER PLANT.—One 1,700 h.p. ASh-82V air-cooled radial engine.

ACCOMMODATION.—Crew of two above and behind engine. Eleven passengers or about fourteen troops can be carried in the cabin. A GAZ-69 "Jeep," a 76 mm. anti-tank gun or two motor-cycle/sidecar combinations are typical military loads.

DIMENSIONS.—
Rotor diameter 17.22 m. (56 ft. 6 in.).
Fuselage length 13.82 m. (45 ft. 4 in.).
Height 4.67 m. (15 ft. 4 in.).

WEIGHTS.—
Normal flying weight 5,450 kg. (12,015 lb.).
Max. flying weight 6,350 kg. (14,000 lb.).
Normal load 1,000 kg. (2,200 lb.).

PERFORMANCE.—
Max. speed 210 km.h. (130 m.p.h.) at 1,500 m. (4,920 ft.).
Cruising speed 195 km.h. (121 m.p.h.).
Service ceiling 4,880 m. (16,000 ft.).
Range 250 km. (155 miles) at 175 km.h. (109 m.p.h.) at 1,500 m. (4,920 ft.).

SUKHOI

PAVEL OSIPOVICH SUKHOI.

Sukhoi is not well-known. He helped to design the Ant-25 and had a share in the construction of the "Rodina" before the last war and his Su-2 attack aeroplane was used in the war. He was responsible for one of the jet aircraft displayed in the 1947 Soviet Aviation Day Display.

Nearly a decade later, on June 24, 1956, there appeared at Tushino three delta-wing experimental fighters or research aircraft from Sukhoi's design offices. They appear to represent three modifications of a basic design and are described separately hereafter.

THE SUKHOI DELTA.

NATO Code Name: "Fishbed A."

The "Fishbed A" has a long tubular fuselage and delta wings with a leading-edge sweepback of approximately 50°, set in a mid or low-mid position. The wing-tips are pointed. The tail unit is conventional but the tailplane is noteworthy in having large forward fillets extending almost to the wing trailing edge. There is a bulge under the rear fuselage, possibly housing a rocket engine.

Span is approximately 7.5 m. (24 ft. 7 in.) and the length 11 m. (36 ft.). Loaded weight is estimated at around 8,500 kg. (18,750 lb.). The power plant is thought to be an axial-flow turbojet giving an output of some 5,000 kg. (11,000 lb.) s.t., perhaps increased by use of an afterburner. The performance may include a top speed of Mach 1.7 at 11,000 m. (36,000 ft.).

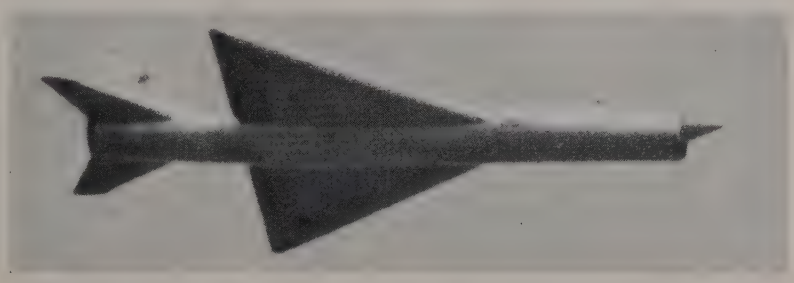
NATO Code Name: "Fishbed B."

The "Fishbed B" is rather similar to the "A" variant but has blunted wing-tips and a centre-body air intake for the power plant. The tailplane lacks the leading edge extensions of the "Fishbed A".

NATO Code Name: "Fishpot."

This aeroplane, which may be a pure research type, appeared at the same display in 1956 as the two "Fishbeds". It is distinguished from them by a conical body at the top of the air intake orifice. This may house flight test instruments. It also has six assisted-take-off rocket attachment points on each side of the fuselage aft of the wing. The top speed has been estimated at Mach 1.5 at 11,000 m. (36,000 ft.).

This particular aircraft is the subject of the illustration below.



The Sukhoi Delta-wing Research Aircraft which is code-named "Fishpot."



The Tu-110 Airliner (four turbojets of unknown type).

ANDREI NIKOLAEVICH TUPOLEV.

A. N. Tupolev still holds an important place in the Russian aeronautical field. Born in 1888, he is apparently still the active head of an important design establishment; for much of his life he has been connected with the TsAGI and TsKB, and designers such as Sukhoi and Petlyakov have been his pupils and collaborators. In March, 1952, Tupolev and thirteen co-workers were awarded a Stalin Prize of 150,000 roubles for "new work in aircraft construction."

Post-war jet designs attributed to Tupolev have included a light twin-jet straight-wing bomber of 1948, the Tu-14, a later development bearing the NATO code name "Bosun," the Tu-16, better known as the "Badger," the Tu-104 twin-jet transport derived from the "Badger" which created such World-wide interest on its first appearance outside the Iron Curtain in the Spring of 1956, and the Tu-110, a four-jet version of the Tu-104.

THE TU-114 ROSSIYA (RUSSIA).

This very large four-turboprop transport was scheduled to fly in October, 1957 to mark the 40th anniversary of the October Revolution.

The prototype was due to make its first flight in the spring of 1957; but is thought to have been delayed. Some provisional information which appeared in 1957 strengthened the view that the Tu-114 might be a civil version of the Tu-20 (?) "Bear" bomber, and that it has a two-deck fuselage with seats for 170-180 passengers, and is powered by four 12,000 h.p. Kuznetsov turboprops. It is intended to fly non-stop from Moscow to Peking or Vladivostock at 900 km.h. (560 m.p.h.).

Antonov is reported to have assisted in the design of this aeroplane, but exact details are still awaited.

THE TU-110.

First shown at a Moscow airport in July, 1957, the Tu-110 is a four-jet version of the Tu-104. It has a longer fuselage than the latter, and its engines are said to have been designed by A. M. Lyulko.

Two versions of the Tu-110 are available, seating 78 and 100 passengers respectively. It has a range of 3,450 km. (2,145 miles) at a cruising speed of 800 km.h. (497 m.p.h.).

THE TU-104.
NATO Code Name: "Camel."

The Tu-104 is a passenger-carrying version of the Tu-16 ("Badger") medium bomber. A new main fuselage (but retaining the nose and flight compartment of the "Badger") is used but the wings (lowered from the mid to low-wing position), tail-unit (with tailplane lowered), landing gear and power plant (with derated civil engines) are all of basic Tu-16 design.

Two versions have been identified:—

Tu-104. Initial production version, as described in detail below.

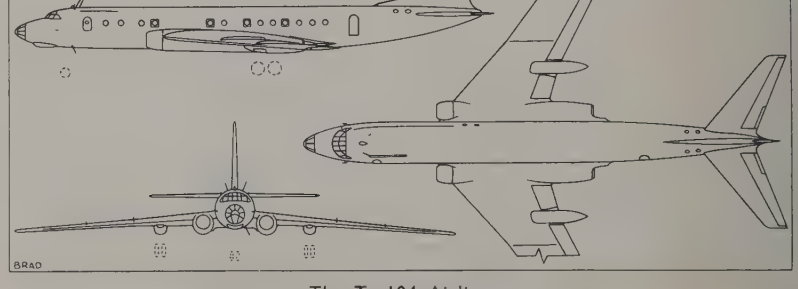
Tu-104A. First shown at a Moscow airport in July, 1957. Basically similar to Tu-104, but with an alternative interior arrangement seating 70 passengers in three saloons, a galley equipped for hot meals, and improved engines modified from the Mikulin M-209 by a design team under P. F. Zubets. Maximum range is given as 3,000 km. (1,865 miles) at a cruising speed of 800 km.h. (497 m.p.h.).

Design work on the Tu-104 was completed in 1954 and the first pre-production aircraft (there was no prototype as such) made its first flight on June 17, 1955. This aircraft flew over Tushino at the Soviet Aviation Display in July, 1955.

Three examples of the Tu-104 visited the London Airport in March and April, 1956, and the type entered regular service with Aeroflot on September 15, 1956. In September, 1957, a Tu-104 carried a load of 21,000 kg. (46,300 lb.) to a height of 11,810 m. (38,713 ft.) and covered 1,930 km. (1,200 miles) at 910 km.h. (565 m.p.h.) with a load of 2,000 kg. (4,400 lb.).

TYPE.—Twin-jet Airliner.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.5. Sweepback inboard of



The Tu-104 Airliner.



The Tu-104 Airliner (two Mikulin M-209 turbojet engines).

first wing fence 40° 30′ outboard 37° 30′. Thickness/chord ratio 12%. Moderate anhedral. All-metal structure. Fowler-type slotted flaps are split by nacelles housing main landing gear units when tetracted. Gross wing area 188 m.² (2,024 sq. ft.).

FUSELAGE.—Circular section all-metal structure. Maximum diameter about 3.4 m. (11 ft. 1½ in.).

TAIL UNIT.—Cantilever monoplane type. Tailplane attached directly to fuselage. All surfaces have 45° sweepback.

LANDING GEAR.—Retractable nose-wheel type. Main four-wheel bogie units retract backwards into special housings extending aft of trailing-edge. Twin-wheel nose unit is steerable and retracts backward into fuselage.

POWER PLANT.—Two Mikulin M-209 axial-flow turbojet engines said to be rated at 6,750 kg. (14,850 lb.) s.t. each at S/L. Fuel in two tanks in each wing and two in fuselage. Total fuel capacity 34,000 litres (7,480 Imp. = 8,970 U.S. gallons).

ACCOMMODATION.—Crew of two pilots, navigator, engineer and radio operator. Navigator's position in glazed nose compartment. Main accommodation can seat 50 passengers in de luxe version or 70-80 in tourist version. The de luxe layout is shown in the accompanying diagram. Cabin is pressurised to a differential of 0.46 kg./cm.² (6.6 lb./sq. in.). but there are individual oxygen outlets at all seats.

DIMENSIONS.—
Span 35 m. (114 ft. 10 in.).
Length 37.05 m. (121 ft. 5 in.).
Height 12 m. (39 ft. 4½ in.).

WEIGHTS AND LOADING.—
Weight empty 19,450 kg. (42,880 lb.).
Weight loaded 55,000 kg. (121,250 lb.).

PERFORMANCE.—
Max. speed 900 km.h. (559 m.p.h.).
Cruising speed 800 km.h. (497 m.p.h.) at 10,000 m. (32,800 ft.).
Climb to 10,000 m. (32,800 ft.) 15 min.
Absolute ceiling 12,000 m. (39,360 ft.).
Ceiling on one engine 5,000 m. (16,400 ft.).
Range (ICAO conditions) 3,200 km. (2,000 miles).

THE TU-16.
NATO Code Name: "Badger."

This Tupolev bomber, from which the Tu-104 civil airliner is derived, made its public appearance in some numbers in 1954. In July, 1955 a formation of 54 was shown together. Quantitative data given below are estimates.

TYPE.—Twin-jet Medium Bomber.

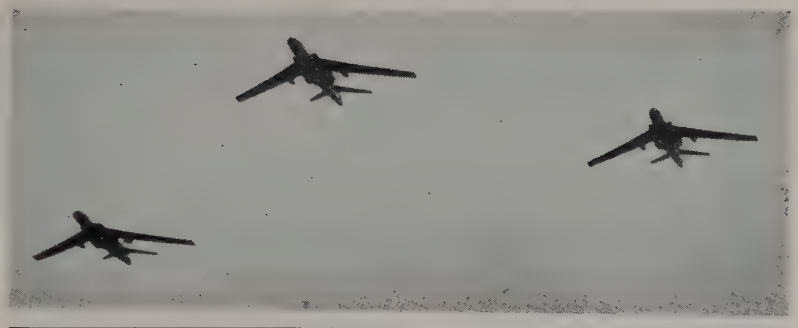
WINGS.—High mid-wing cantilever monoplane with slight anhedral and with approximately 35° of sweep at 50% of chord.

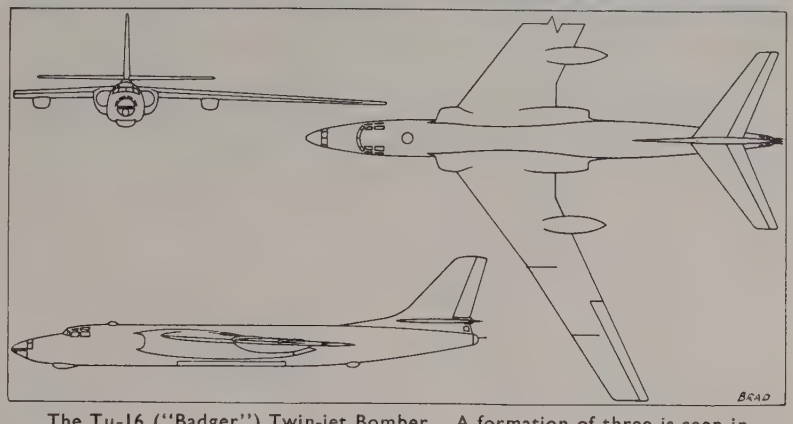
FUSELAGE.—Long circular-section structure.

TAIL UNIT.—Swept cantilever type with slight tailplane dihedral.

LANDING GEAR.—Tricycle type. The main wheel bogies retract into special housings projecting beyond the wing trailing-edge.

POWER PLANT.—Possibly two M-209 axial-flow twin-spool turbojets each with a military rating of about 8,200 kg. (18,040 lb.) s.t. at sea level.





The Tu-16 ("Badger") Twin-jet Bomber. A formation of three is seen in the photograph above.

ACCOMMODATION.—Glazed nose and pilot's positions, manned tail position plus lateral observation blisters in the rear fuselage under the tailplane. Crew of 5-6.

ARMAMENT.—Forward dorsal and rear ventral barbettes and two fixed forward firing guns in the sides of the lower fuselage. The tail position is provided with armament controlled by an automatic gun-ranging radar set. Bomb load about 4,500 kg. (9,920 lb.) delivered from bomb bay about 6.5 m. long.

EQUIPMENT.—Radio and radar aids probably include HF and VHF R/T equipment, as well as IFF and a radio compass and radio altimeter. A radome under the nose contains scanner type radar, probably an improved version of that fitted in the Il-28.

DIMENSIONS.—
Span 35.4 m. (116 ft. 1 in.).
Length 36 m. (118 ft.).
Wing area 186 m.² (2,002 sq. ft.).

WEIGHTS.—
Loaded weight 68,000 kg. (149,940 lb.).

PERFORMANCE.—
Max. speed 900 km.h. (559 m.p.h.).
Range 6,950 km. (4,320 miles).



The Tu-20(?) Bomber which is code-named "Bear."

THE TU-20 (?).
NATO Code Name: "Bear."

This huge Tupolev bomber was first seen at Tushino in July, 1955 and has since entered service with units of the VVS. Its designation is allegedly Tu-20.

The general layout can be gathered from the illustration. Precise details are unconfirmed, but it is very probable that the power plants are Kuznetsov turboprops, each giving 12,000 h.p. at sea level. They drive large contra-rotating airscrews.

There is a "chin" radar scanner, dorsal and ventral armament in turrets, and a manned tail gun position. Besides this last, there are two blisters on the rear fuselage, under the tailplane, either for observation or for extra armament. A braking parachute may be used for reducing the landing run.

Approximate dimensions are: span 57.8 m. (189 ft. 7 in.), length 42.2 m. (138 ft. 6 in.).

THE TU-14 NAVAL BOMBER.
NATO Code Name: "Bosun."

This aircraft was mentioned in the U.S.A. in 1952 as a new light Russian bomber, with a higher performance than the Il-28. It is reported to have been produced for naval use.

This bomber is closely related to the Tu twin-jet bomber of 1948, but has a radome, blunter tail, fin extension, and a sloping trailing-edge to the rudder.

TYPE.—Twin-jet Attack Bomber.

WINGS.—Shoulder-wing all-metal cantilever monoplane.

FUSELAGE.—Circular section all-metal structure.

TAIL UNIT.—Swept-back tailplane. Low aspect-ratio fin and rudder with fin extension.

LANDING GEAR.—Retractable nose-wheel type. Main wheels retract into nacelles.

POWER PLANT.—Two VK-1 centrifugal-flow turbojet engines.

ACCOMMODATION.—Raised cockpit hood. Probably a nose position for bomb-aimer. Existence of tail position uncertain.

ARMAMENT.—Believed two guns under nose. Twin guns in tail.

DIMENSIONS (Approx.).—
Span 25.5 m. (83 ft.).
Length 24.4 m. (80 ft.).

WEIGHTS AND PERFORMANCE.—
No data available.

YAKOVLEV

ALEKSANDIR SERGIEVICH YAKOVLEV.

Yakovlev has shown himself, by his products, to be of the same order of versatility as A. N. Tupolev. He has gradually developed his designs from the earliest days, when he produced sailplanes and light sportplanes, through the trainer period and into the times when his famous piston-engined fighters made the largest contribution to Russian fighter strength. Late developments of the Yak-9, notably the Yak-9P, are still in service with the satellite countries. A number of Yak-9P's were encountered in combat over Korea in 1950.

The latest Yakovlev designs are the Yak-25 twin-jet fighter and the Yak-24 twin-rotor transport helicopter. The general utility Yak-12 and Yak-18 in their latest forms are in widespread use.

The Yak-11 trainer is in use by the Soviet Air Fleet and by civilian aviation clubs, and has also appeared in Rumania, Hungary and Korea. The F.A.I. has homologated two records for this type. In August, 1950 Ya. D. Forostenko flew a Yak-11 with take-off weight of 2,213 kg. (4,868 lb.) at an average speed of 441 km.h. (273.86 m.p.h.) over 500 km. (310.5 miles), and in September, 1950, Vladimir Markov flew a Yak-11 over 100 km. (62.1 miles) at an average speed of 479 km.h. (297.46 m.p.h.).

THE YAK-25.

NATO Code Name: "Flashlight A."

This twin-jet night and all-weather fighter was seen publicly for the first time at Tushino in July, 1955. In appearance generally it resembles the S.O. 4050 Vautour quite closely.

The code name for the basic Yak-25 is "Flashlight." Two developments of the Yak-25, first seen at Tushino in 1956, are identified as follows :—

NATO Code Name "Flashlight B."

This version has a pointed glazed nose presumably to accommodate a bomb-aimer. The cockpit canopy has been redesigned for a single occupant. This version is thought to be a light bomber or pathfinder.

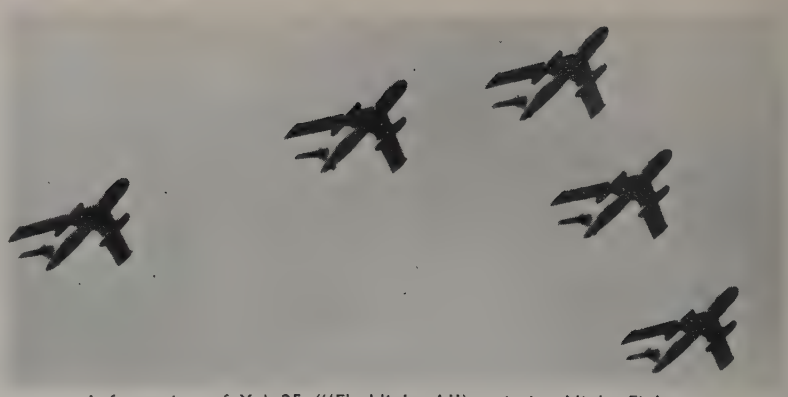
NATO Code Name: "Flashlight C."

This model has a revised nose shape. The radome is pointed in contrast with the blunted radome of the original "Flashlight."

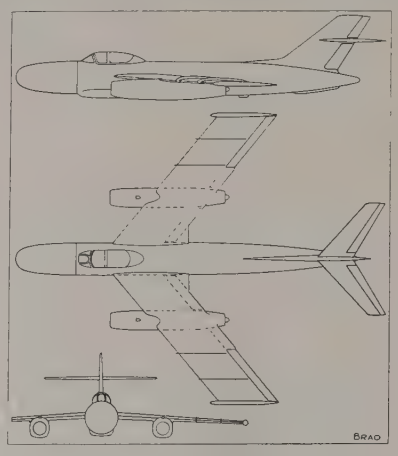
TYPE.—Twin-jet Night/All-weather Fighter.

WINGS.—Mid-wing cantilever monoplane. Anhedral approximately 3°. Leading-edge sweepback 45°. Trailing-edge of centre-section straight. Outer wings are of constant chord. Two fences on each side.

FUSELAGE.—Circular-section all-metal structure.



A formation of Yak-25 ("Flashlight A") twin-jet Night Fighters.



The Yak-25 "Flashlight A"

TAIL UNIT.—All surfaces swept. Tailplane mounted midway up fin. Small ventral keel.

LANDING GEAR.—Tandem, or "bicycle", type with single front wheel just aft of radome and twin rear wheels aft of wing trailing-edge, all retracting aft into fuselage. Small wheels in housings at wing-tips act as stabilisers on ground.

POWER PLANT.—Two small-diameter axial-flow turbojet engines, estimated to be of about 3,200 kg. (7,055 lb.) s.t. each.

ACCOMMODATION.—Crew of two in tandem.

ARMAMENT.—Includes two heavy guns in lower forward fuselage and possibly a rocket-launching tray.

DIMENSIONS (estimated).—
Span 12.40 m. (40 ft. 8 in.).
Length 16.65 m. (54 ft. 7½ in.).

PERFORMANCE (estimated).—
Max. speed 1,100 km.h. (683 m.p.h.) at S/L.

THE YAK-24 HELICOPTER.

NATO Code Name: "Horse."

The Yak-24 was designed by A. S. Yakovlev and N. K. Skrzhinskii, with ten other co-workers. It was first seen at Tushino in 1955.

On December 17, 1955, two international class records were set up by a Yak-24, which lifted a load of 2,000 kg. (4,409 lb.) to a height of 5,082 m. (16,673 ft.) and 4,000 kg. (8,818 lb.) to 2,000 m. (6,562 ft.). The latter record has since been beaten.

TYPE.—Tandem-rotor Transport Helicopter.

ROTORS.—Two four-blade rotors rotating in opposite directions. Each is driven by its own engine but rotors are inter-connected by torsion shaft so that rotation continues should one engine fail.

FUSELAGE.—Rectangular-section steel-tube structure in three sections. Front and rear sections are metal-covered, middle section is fabric covered.

LANDING GEAR.—Four wheels with 5.3 m. (17 ft. 5 in.) track. Oleo shock-absorbers.

POWER PLANT.—Two 1,700 h.p. ASh-82V fourteen-cylinder radial air-cooled engines, either of which is capable of turning both rotors.

ACCOMMODATION.—Forward cabin accommodates crew of 3-4, pilot, co-pilot, navigator/radio operator. A passage alongside front engine, which can be inspected in flight, leads to main hold or cabin. Varying loads may be carried—typical of which are three normal size trucks; two GAZ-69 Jeeps; one GAZ-69 towing twin-barrelled 14.5 mm. A.A. machine-gun, plus crew of 6; or up to perhaps 40 persons. The rear section of the fuselage includes a loading ramp for loading wheeled or tracked vehicles, heavy equipment, etc. Cabin length 10 m. (33 ft.).

DIMENSIONS (approx.).—
Rotor diameter 17.22 m. (56 ft. 6 in.).
Length of fuselage 17.5 m. (57 ft. 5 in.).
Length overall rotors turning 28.2 m. (92 ft. 6 in.).



The Yak-24 Transport Helicopter (two 1,700 h.p. ASh-82V engines).

Height to top of rear rotor head 5.2 m. (17 ft.).

WEIGHTS (approx.).—
Useful load 4,000 kg. (8,800 lb.).
Weight loaded 16,000 kg. (35,200 lb.).

PERFORMANCE.—
Cruising speed approx. 177 km.h. (110 m.p.h.).
Service ceiling 5,500 m. (18,000 ft.).
Range 800 km. (497 miles).

THE YAK-18.
NATO Code Name: "Max."

TYPE.—Two-seat Training monoplane.

WINGS.—Low-wing cantilever monoplane. Dihedral 7° 20'. Metal structure, leading-edge stiffened with aluminium sheet, and fabric covering. Large ailerons in outer panels; one-piece flap across centre-section at trailing-edge. Wing area 16.9 m.² (183 sq. ft.).

FUSELAGE.—Steel-tube structure, with built-up formers and longerons. Metal covering back to rear cockpit, fabric covering on rear section.

TAIL UNIT.—Braced monoplane type with single fin and rudder. Fabric covering on all surfaces. Trim tab in rudder.

LANDING GEAR.— Retractable tail-wheel type. Wheels retract pneumatically backwards into wells in wing, about half of wheel remaining exposed. Pneumatic brakes. Fixed castoring tail-wheel.

POWER PLANT.—One 160 h.p. M11-RF five-cylinder air-cooled single-row radial engine in "helmeted" cowl. VISh(a) two-blade variable-pitch metal airscrew. Diameter 2 m. (6 ft. 6½ in.). Special fuel and oil systems for prolonged inverted flight. Fuel in two tanks in wing roots, with total capacity of 130 litres (28.5 Imp. gallons).

ACCOMMODATION.—Two seats in tandem beneath continuous canopy raised above top-line of fuselage. Separate rearward-sliding hoods.



The Yak-18U Trainer (160 h.p. M-11 engine).

EQUIPMENT.—Includes blind-flying instruments, radio receiver and transmitter.

DIMENSIONS.—
Span 10.6 m. (34 ft. 9 in.).
Length 8.07 m. (26 ft. 6 in.).
Height 3.1 m. (10 ft. 4 in.).

WEIGHTS.—
Weight empty 816 kg. (1,795 lb.).
Weight loaded 1,120 kg. (2,470 lb.).

PERFORMANCE.—
Max. speed 248 km.h. (153 m.p.h.).
Cruising speed 215 km.h. (133.5 m.p.h.).
Landing speed 85 km.h. (53 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min.
Service ceiling 4,000 m. (13,120 ft.).
Max. range 1,000 km. (620 miles).
Take-off run 290 m. (316 yds.).
Landing run 247 m. (270 yds.).

THE YAK-18U.

The Yak-18U is a modified version of the Yak-18 trainer, with tricycle landing gear.

The main wheels have been repositioned to an attachment at the rear spar, and retract forward; the nose-wheel retracts to the rear. The forward part of the fuselage has been somewhat lengthened. The cylinder head covers of the cowling of the M-11 FR-1 motor have been modified to permit a more extensive frontal air entry.

DIMENSIONS.—
Span 10.60 m. (34 ft. 9½ in.).
Length 8.35 m. (27 ft. 5 in.).

WEIGHTS.—
Weight empty 970 kg. (2,138 lb.).
Weight loaded 1,300 kg. (2,866 lb.).



The Yak-18 Trainer (160 h.p. M-11 engine).

PERFORMANCE.—
Max. speed 235 km.h. (146 m.p.h.).
Landing speed 103 km.h. (64 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min. 12 sec.
Range 900 km. (560 miles).

THE YAK-12.
NATO Code Name: "Creek."

The original Yak-12 prototype appeared in 1944. Powered by the 145 h.p. M-11 engine, the Yak-12 began to replace the Po-2 for certain duties in 1949 but few civilian examples appeared. Later sub-types, designated Yak-12R and Yak-12M, exist in civil form.

Yak-12R. Modern development of Yak-12 powered by a 220 h.p. AI-14R nine-cylinder radial engine. Prototype first flew in 1952 and since then the Yak-12R has been supplied steadily to various aviation institutions. Basically a general purpose four-seat aircraft. One specific use is that of glider-tug.

Yak-12M. Improvement of Yak-12R introduced in late 1955 or early in 1956. Power plant is the same and in general the appearance is little altered except for the addition of a fin extension along top of fuselage. This version provided in passenger, ambulance, freight and agricultural versions. Under field conditions two men can modify the passenger version into an ambulance or freight version in 25-30 minutes, or to the agricultural version in 2½-3 hours.

The following data apply specifically to the Yak-12M.

TYPE. — Single-engined General Purpose monoplane.

WINGS.—High-wing rigidly-braced monoplane. All-metal two-spar structure. Vee bracing struts. Slotted ailerons and slotted flaps. Leading-edge slats. Wing area 23.86 m.² (256.8 sq. ft.).

FUSELAGE.—Rectangular welded steel-tube structure covered with metal and fabric.

TAIL UNIT.—Braced monoplane type. Metal frames, fabric covering.

LANDING GEAR.—Fixed type.

POWER PLANT.—One 240 h.p. AI-14R nine-cylinder radial air-cooled engine. Two-blade V-530-D 11 variable-pitch airscrew. Multi-blade cooling fan at front of cowling.

ACCOMMODATION.—Cabin normally seats four in two pairs. Ambulance version carries pilot, one seated patient and one stretcher case and a medical attendant. Large triangular loading hatch on port side at rear of cabin for loading stretcher or freight. The freight version has attachment lugs for securing loads up to 300 kg. (660 lb.). The agricultural version has a special container of 470 litres capacity for chemicals and apparatus for spraying, etc.

DIMENSIONS.—
Span 12.60 m. (41 ft. 4 in.).
Length 9.0 m. (29 ft. 6 in.).
Height 3.12 m. (10 ft. 3 in.).

WEIGHTS.—
Weight empty (Yak-12M) 1,026 kg. (2,262 lb.).
Weight loaded (Yak-12R) 1,285 kg. (2,833 lb.).
Weight loaded (Yak-12M) 1,450 kg. (3,197 lb.).

PERFORMANCE (Yak-12R).—
Max. speed 184 km.h. (114 m.p.h.).
Range 500 km. (310 miles).
T.O. run 75 m. (246 ft.).
Landing run 65 m. (213 ft.).



The Yak-12M General Purpose Monoplane (240 h.p. AI-14R engine).

PERFORMANCE (Yak-12M).—
Max. speed 182 km.h. (113 m.p.h.).
Cruising speed 160 km.h. (99 m.p.h.).
Landing speed 73 km.h. (45.4 m.p.h.).
Rate of climb at S/L 245 m./min. (805 ft./min.).
Ceiling 4,160 m. (13,650 ft.).
Range 765 km. (475 miles).

THE YAK-11.

NATO Code Name: "Moose."

The Yak-11 is licence-built in Czechoslovakia as the C-11.

TYPE.—Two-seat intermediate and advanced trainer.

WINGS.—Low-wing cantilever monoplane. Modified Clark YA section. Sharp straight taper on leading and trailing-edges to rounded tips. Dihedral from roots. Small ailerons, and split flaps extending along trailing-edge from ailerons to meet at fuselage centre. Wing area 15.40 m.² (166 sq. ft.).

FUSELAGE.—Circular section forward, tapering in plan back to tail unit.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. Sharp straight taper on tailplane leading-edge, slight taper on trailing-edge, with rounded tips and cut-out for rudder movement. Inset elevators, with trim-tabs. Fin has straight leading-edge and rounded top; trailing-edge of rudder is rounded.

LANDING GEAR.—Retractable tail-wheel type. Main legs and wheels retract inwards to lie flush in wing beneath fuselage. Fixed tail-wheel. Wheel track 3.435 m. (11 ft. 3¼ in.).

POWER PLANT.—One ASh-21 seven-cylinder air-cooled single-row radial engine, using direct fuel injection. Take-off power 750 b.h.p. at 2,300 r.p.m. at sea level. Max. continuous cruising rating 680 b.h.p. at 1,900 r.p.m. VISh-11 V-20 two-blade metal controllable-pitch airscrew. Fuel capacity 360 litres (79 Imp. gallons). Oil capacity 37.5 litres (8.25 Imp. gallons).

ACCOMMODATION.—Two seats in tandem beneath long "glass-house" enclosure raised above top line of fuselage.

ARMAMENT.—A single machine-gun can be installed on top port side of engine cowling for gunnery training.

EQUIPMENT.—Includes full radio receiver and transmitter sets. A camera can be mounted forward of canopy on windscreen framework.

DIMENSIONS.—
Span 9.40 m. (30 ft. 10 in.).
Length 8.50 m. (27 ft. 10¾ in.).
Height 3.283 m. (10 ft. 9¼ in.).

WEIGHTS.—
Weight empty 2,000 kg. (4,410 lb.).
Weight loaded 2,500 kg. (5,512 lb.).



The Yak-11 Advanced Trainer (750 h.p. ASh-21 engine).

PERFORMANCE.—
Max. speed at S/L 424 km.h. (263 m.p.h.).
Max. speed at 2,250 m. (7,380 ft.) 460 km.h. (286 m.p.h.).
Landing speed 127 km.h. (79 m.p.h.).
Service ceiling 7,100 m. (23,300 ft.).
Take-off run 500 m. (1,640 ft.).
Landing run 1,040 m. (3,410 ft.).
Max. range 1,280 km. (795 miles).

THE YAK-11U.

The Yak-11U is a version of the standard Yak-11 trainer with a tricycle landing gear. The fuselage has been slightly lengthened, and the main wheels repositioned.

The Yak-11U is built in Czechoslovakia as the C-11U.

WEIGHTS.—
Weight empty 2,066 kg. (4,555 lb.).
Weight loaded 2,500 kg. (5,512 lb.).

MISCELLANEOUS UNIDENTIFIED AIRCRAFT.

Hereafter are listed five Russian military aircraft concerning which insufficient information is available to enable them to be positively identified.

1. A swept-wing fighter code-named "Faceplate," and attributed by some sources to Mikoyan and Gurevich, was first shown publicly at Tushino in 1956. It is possibly powered by a single axial-flow turbojet of about 5,000 kg. (11,000 lb.) s.t., and a bulge under the rear fuselage may house an auxiliary rocket motor.

Approximate characteristics are: length 11 m. (36 ft.); weight loaded 8,200 kg. (18,000 lb.); and maximum speed Mach 1.6 at 11,000 m. (36,000 ft.).

2. This unidentified fighter code-named "Fitter," which was exhibited briefly at Tushino in 1956, resembles fairly closely the MiG-19 and "Faceplate."

Noteworthy points are the centre-body intake to the large axial-flow turbojet, and the broad-chord wing-roots.

The span is thought to be about 11.5 m. (37 ft. 9 in.), and the length 12.75 m. (41 ft. 10 in.).

3. This bomber, code-named "Blowlamp," was shown to Western aeronautical representatives at Kubinka in June, 1956, and is reported to be a Yakovlev design. Its sharply-swept wing is mounted near the top of the fuselage, with two turbojets slung in "pods" underneath, rather in the manner of the Douglas B-66. The tail surfaces are also swept. The glazed nose portion holds a crew of two or possibly three; there is a two-gun tail turret but full armament details are not available. A tandem undercarriage is fitted with outrigger wheels that retract into wing-tip fairings.

Approximate span is 20 m. (65 ft. 6 in.), and length about 24 m. (78 ft. 9 in.).

4. Among new Soviet military aeroplanes shown to Western aeronautical representatives at Kubinka in June, 1956 was a twin-jet ground attack monoplane with ventral armour plating. No details are available.

5. Another Kubinka revelation was a single-engined naval attack aeroplane. This was powered by a turboprop engine driving contra-props. It is thought to be adaptable for use as an anti-submarine aircraft but was also stated to be liberally equipped with external racks for bombs, torpedoes, etc.



The unidentified Fighter code-named "Fitter" which was seen at Tushino in 1956.

SPAIN

AERO DIFUSIÓN

AERO-DIFUSIÓN S.L.

HEAD OFFICE AND WORKS: AERODROMÓ DE LA ALBERÍCIA, SANTANDER.

President: Adolfo F. L. Merino.

Technical Director: P. F. Fernández.

Chief Aeronautical Engineer: E. C. Alviñana.

General Manager: E. L. Merino.

After first building experimentally a French-designed Jodel D.112 lightplane in 1954, this company was registered on May 6, 1955, to manufacture, overhaul and repair aircraft.

It is now building under licence the dual-control two-seat Jodel D.112, the single-seat Jodel D.9 and the single-seat Druine Turbulent, all of which are described in the French section of this work. A D.112 built by Aero-Difusión was the first aircraft of Spanish construction to be exported to a foreign country.



The Spanish-built Jodel D.112 (65 h.p. Continental A65 engine).

AEROTECNICA

AEROTECNICA S.A.

HEAD OFFICE: VELÁZQUEZ, 38, MADRID.

Aerotecnica S.A. has formed a helicopter department which it has placed under the technical direction of the French engineer Jean Cantinieau.

Aerotecnica began by engaging the services of M. Cantinieau and at the same time acquiring the Matra-Cantinieau MC-101 light helicopter which was built by the French Société Matra in 1952. This helicopter was given the designation AC-11 (Aerotecnica-Cantinieau-11).

From the AC-11 have been developed the AC-12 and AC-13, the former powered by a 150 h.p. Lycoming O-320 engine and the latter by a Turbomeca Artouste I gas turbine.

Two prototypes of the AC-12 were built in Madrid by the A.I.S.A. company and ENHASA, the national airscrew company. A production order for 12 more has been received from the Spanish Government. Two prototypes of the AC-13 were built in France by the Société Nationale de Constructions Aéronautiques du Nord (S.N.C.A.N.), which had acquired a licence to build the AC-13 and by whom it was known as the Nord 1750 Norelfe. This licence has now lapsed and the two prototypes have been acquired by the Spanish Government

An improved version of the AC-13, known as the AC-14, has now been designed and the first of six AC-14's on order is being completed in Madrid by ENHASA. In addition, Aerotecnica is working on the design of the AC-15 helicopter, powered by a 245-260 h.p. Lycoming O-435-V engine.

A further development is the AC-21, a projected 10-12 passenger helicopter powered by two Turbomeca Bastan turbines.



The Aerotecnica AC-12 Helicopter (150 h.p. Lycoming O-320 engine).

THE AEROTECNICA AC-12.

Like the original Matra-Cantinieau MC-101, the AC-12 has its engine mounted above the cabin. Two prototypes are being built by the A.I.S.A. company, with a transmission and reduction gear designed on motor-car principles and built by the ENHASA airscrew company. The Spanish Government has ordered twelve of these aircraft.

TYPE.—Two-seat Single-rotor Helicopter.

ROTOR.—Three-blade rotor with double-articulated blades. Each blade has a solid machined duralumin spar which forms the leading-edge, duralumin ribs and trailing-edge. Space between ribs is filled with a plastic foamed resin compound named Klegecell, with a final overall covering of Fibreglas. Floating hub, with cyclic and collective-pitch changes made through a "spider." Rotor blade area 0.9405 m.² (10.1 sq. ft.). Rotor disc area 57 m.² (613.3 sq. ft.). Three-blade anti-torque rotor of similar construction to main rotor. Anti-torque rotor blade area 0.0927 m.² (1.0 sq. ft.). Anti-torque rotor disc area 2.26 m.² (24.3 sq. ft.).

ROTOR DRIVE.—The main rotor is driven direct from the engine gear-box (7.28 : 1 ratio) and clutch through a universal joint. The anti-torque rotor is driven through a gear-box (1.43 : 1 ratio) and cardan shaft.

FUSELAGE.—Light alloy structure.

LANDING GEAR.—Skid type. Track of skids 2.0 m. (6 ft. 6 in.).

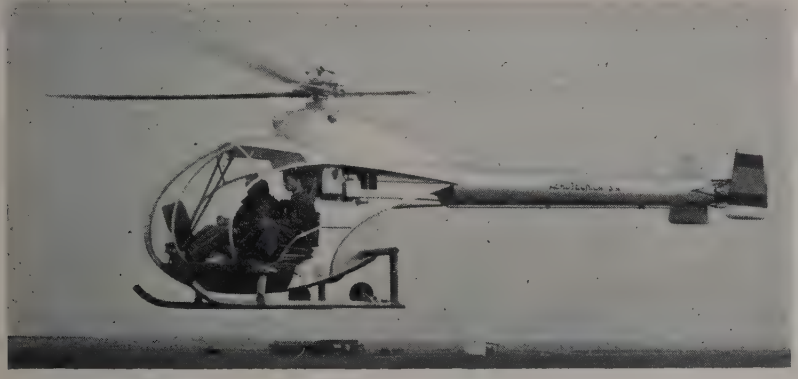
POWER PLANT.—One 150 h.p. Lycoming O-320 fan-cooled engine mounted above the cabin with direct drive through the gear-box to the main rotor. Fuel tank behind cabin. Fuel capacity 90 litres (20 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Entrance door on each side of cabin.

DIMENSIONS.—
- Main rotor diameter 8.50 m. (27 ft. 10 in.).
- Overall length 8.30 m. (27 ft. 9 in.).
- Length of fuselage 7.35 m. (24 ft. 1 in.).
- Overall height (to top of rotor pylon) 2.75 m. (9 ft.).
- Width of fuselage 1.22 m. (4 ft.).
- Diameter of anti-torque rotor 1.70 m. (5 ft. 6 in.).

WEIGHTS.—
- Weight empty 480 kg. (1,056 lb.).
- Disposable load 240 kg. (528 lb.).
- Weight loaded 720 kg. (1,584 lb.).

PERFORMANCE.—
- Max. speed at S/L. 121 km.h. (75 m.p.h.).
- Cruising speed 102 km.h. (63 m.p.h.).
- Hovering ceiling with ground effect 1,770 m. (5,800 ft.).
- Best rate of climb at S/L. 258 m./min. (846 ft./min.).
- Service ceiling 3,100 m. (10,200 ft.).
- Still air cruising range 216-324 km. (135. 200 miles).



The Aerotecnica AC-13A Helicopter (Turbomeca Artouste I shaft turbine).

THE AEROTECNICA AC-13A.

The three-seat AC-13A is similar in general arrangement to the AC-12 but is fitted with a Turbomeca Artouste I shaft turbine power-unit which is mounted behind the cabin and drives the main rotor through clutch and gear-box. The residual thrust of some 60 kg. (132 lb.) is ducted through the tubular rear fuselage and is used for torque compensation and directional control. For the latter the rear end of the jet duct is provided with an articulated extension with apertures to the right and left. Movement of this section is by pedal control and the same control linkage moves two small vertical fins, which provide added control in cruising flight and during autorotation.

It is planned to arrange the tail nozzle so that at high cruising speeds all residual thrust can be vented rearward to provide

forward thrust, only the fins being used for directional control.

Two prototypes of the AC-13A were built by S.N.C.A.N. (France), who then held the licence rights and the first of these flew in July, 1954. Known as the Nord 1750 Norelfe, these prototypes have now been acquired by the Spanish Government.

TYPE.—Three-seat Single-rotor Helicopter.

ROTOR.—Three blade rotor with double-articulated blades of similar construction to those of AC-12. Rotor blade area each 0.99 m.² (10.66 sq. ft.). Rotor disc area 64 m.² (689 sq. ft.). Anti-torque control by jet-deflection.

ROTOR DRIVE.—The main rotor is driven directly from the turbine gear-box (16.7 : 1 ratio) and clutch through a universal joint.

FUSELAGE.—Light alloy structure.

LANDING GEAR.—Skid type. Track of skids 2.0 m. (6 ft. 6 in.).

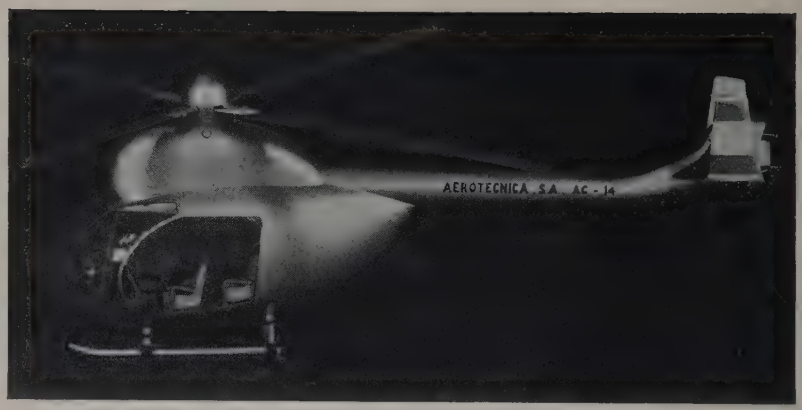
POWER PLANT.—One 260 h.p. Turbomeca Artouste I shaft turbine. In practice, only 170 h.p. are taken by the transmission, of which 146 h.p. are applied to the rotor and 24 h.p. absorbed by the reduction gearing. The remaining 90 h.p. (equivalent to 60 kg.=132 lb. s.t.) are used for anti-torque control. Total fuel capacity 115 litres (25 Imp. gallons). Oil capacity 20 litres (4.4 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating pilot in front and two passengers side-by-side behind. Entrance door on each side of cabin.

DIMENSIONS.—
Main rotor diameter 9.04 m. (30 ft. 9 in.).
Overall length 7.80 m. (25 ft. 7 in.).
Length of fuselage 7.50 m. (24 ft. 7 in.).
Height (to top of rotor pylon) 2.75 m. (9 ft.).

WEIGHTS.—
Weight empty 575 kg. (1,265 lb.).
Weight loaded 880 kg. (1,940 lb.).

PERFORMANCE.—
Max. speed at S/L. 140 km.h. (87 m.p.h.).
Cruising speed 124 km.h. (77 m.p.h.).
Hovering ceiling with ground effect 2,650 m. (8,700 ft.).
Best rate-of-climb at S/L. 276 m./min. (905 ft./min.).
Service ceiling 6,065 m. (19,900 ft.).
Still air cruising range 140-345 km. (87-215 miles).



A model of the Aerotecnica AC-14 Five-seat Helicopter.

THE AEROTECNICA AC-14.

The AC-14 is an enlarged version of the AC-13, powered by a Turbomeca Artouste II shaft turbine and with accommodation for five persons. As in the AC-12, the engine is mounted above the cabin, which is extensively sound-proofed. Residual thrust is used to increase forward speed, leaving the movable tail fins to provide anti-torque and directional control.

Six AC-14's are being built by the ENHASA company.

TYPE.—Five-seat Single-rotor Helicopter.

ROTOR.—Four-blade rotor with double-articulated blades of similar construction to those of AC-12. Rotor blade area each 1.056 m.² (11.37 sq. ft.). Rotor disc area 72.35 m.² (778.78 sq. ft.). Anti-torque control by gas deflection in helicopter flight and by vertical rudders in gyrodyne flight (high speed cruising).

ROTOR DRIVE.—The main rotor is driven directly from the turbine gear-box (17.75 : 1 ratio) through a universal joint.

FUSELAGE.—Light alloy structure.

LANDING GEAR.—Skid type. Track of skids 2.0 m. (6 ft. 6 in.).

POWER PLANT.—One Turbomeca Artouste II shaft-turbine, developing 320 h.p. and 80 kg. (176 lb.) residual thrust. During vertical climb, 250 h.p. are taken by the main transmission, of which 213 h.p. are applied to the rotor. Maximum continuous power is 220 h.p. in the transmission and 187 h.p. at the rotor.

ACCOMMODATION.—Enclosed cabin seating pilot at the front and four passengers in two side-by-side pairs behind. Entrance door on each side of cabin.

DIMENSIONS.—
Main rotor diameter 9.60 m. (31 ft. 6 in.).
Overall length 11.22 m. (36 ft. 9 in.).
Length of fuselage 8.25 m. (27 ft. 1 in.).
Height (to top of rotor pylon) 3.10 m. (10 ft. 2 in.).

WEIGHTS.—
Weight empty 625 kg. (1,378 lb.).
Weight loaded 1,200 kg. (2,646 lb.).

PERFORMANCE (estimated).—
Max. speed (max. cont. power) at S/L. 160 km.h. (99 m.p.h.).
Cruising speed 120 km.h. (75 m.p.h.).
Best rate of climb at S/L. 277 m./min. (910 ft./min.).
Service ceiling 6,350 m. (20,830 ft.).

AISA

AERONAUTICA INDUSTRIAL S.A.

HEAD OFFICE : PLAZA DE LAS CORTES 2, MADRID.

WORKS AND AERODROME : CARABANCHEL ALTO, MADRID

President : Sr. Conde de Mieres.
Chairman : D. Lázaro Ros España.

This concern, with fully-equipped works and adjoining aerodrome at Carabanchel Alto (Madrid), has since 1923 been engaged in the manufacture, reconstruction and repair of aircraft of wood and mixed construction.

In 1943, three types were produced, the H.M.1 and H.M.5 trainers and the H.M.9 glider-tug. In 1945 the H.M.2 was completed and in 1947 prototypes of the H.M.3 seaplane and the H.M.7 four-seat cabin monoplane were built. All these aircraft, which have been illustrated and described in previous editions of "All the World's Aircraft," were designed by the Instituto Nacional de Técnica Aeronautica (INTA) and were built by the Aeronautica Industrial S.A. (AISA).

In 1946 AISA collaborated with Iberavia S.A. in the construction of various types of aircraft designed by that company, including the I-11 and I-115.

The Aircraft Department of Iberavia S.A. has now been taken over by Aeronautica Industrial S.A., which is continuing the production of the I-115. It has also completed the I-11B, a developed version of the I-11 with a tail-wheel landing-gear. The prototype flew for the first time on October 16, 1953, and the aircraft is now going into series production for the use of aero clubs and for private pilots.

The latest product of Aeronautica Industrial S.A. is the AVD-12 three-seat liaison monoplane, the company's first all-metal aircraft. It was designed by the well-known French aircraft engineer Emile Dewoitine.

AISA is also building the AC-12 helicopter on behalf of Aerotecnica S.A.



The AISA AVD-12 (150 h.p. ENMA Tigre G-IV-B engine).

THE AISA AVD-12.

The AVD-12 was designed to meet the requirements of a Spanish government specification issued in 1953. Two prototypes have been built :—

AVD-12. First prototype. 150 h.p. ENMA Tigre G-IV-B engine. First flew on August 18, 1955.

AVD-12C. Second prototype. 225 h.p. Continental O-470-A engine.

TYPE.—Four-seat general purpose cabin monoplane.

WING.—High-wing cantilever monoplane. Thickness-chord ratio gradually reduced from 18% inboard to 9% at tip. Wings designed for quick and easy removal in the field. All-metal single-spar structure with torsion box leading-edge. Excellent high-lift characteristics and good lateral control achieved by double trailing-edge surfaces in the form of full-span slotted ailerons in eight sections mounted on a full-span slotted flap. Hydraulic inter-connection changes tailplane incidence when flaps are lowered. Flaps are all-metal. Ailerons have metal structure with fabric-covering aft of metal leading-edge. Range of movement of flaps 40°. Range of movement of ailerons 20-25° in all flap positions. Total area of ailerons 2.130 m.² (22.9 sq. ft.). Total area of flaps 2.40 m.² (25.8 sq. ft.). Gross wing area 18 m.² (193.6 sq. ft.).

FUSELAGE.—Elleptical-section all-metal semi-monocoque structure

TAIL UNIT.—Cantilever monoplane type. Single-spar all-metal variable incidence tailplane, adjustable by pilot and linked hydraulically to wing flaps. Single-spar all-metal fin. All-metal elevators. Fabric-covered rudder.

LANDING GEAR.—Fixed tail-wheel type. All three units have Dewoitine type oleo-pneumatic shock-absorbers, those for the main wheels being mounted transversely under the cabin floor. Hydraulic brakes can be operated differentially for steering. Castoring tail-wheel with pilot-applied lock.

POWER PLANT (AVD-12).—One 150 h.p. ENMA Tigre G-IV-B four-cylinder in-line inverted air-cooled engine on a welded steel tube mounting. ENH-P.8 two-blade fixed-pitch metal airscrew.

Power Plant (AVD-12C).—One 225 h.p. Continental O-470-A six-cylinder horizontally-opposed air-cooled engine on welded steel tube mounting. McCauley Met-L-Matic two-blade variable-pitch airscrew. Ejector-type engine cooling. Fuel in wing tanks with total capacity of 160 litres (35 Imp. gallons).

Accommodation (AVD-12).—Cabin seats two side-by-side with dual controls, with seat for one or two persons behind. Luggage compartment. Four car-type doors. Windscreens, rear hood, roof and side windows of plexiglas. Stretcher can be loaded through rear starboard door for ambulance duties. Equipment can include mailbag-snatching gear, towing fittings and agricultural equipment.

Accommodation (AVD-12C).—Cabin seats four in two pairs. Dual controls. Remainder as for AVD-12.

Dimensions —
Span 11.1 m. (36 ft. 5 in.).
Length 7.75 m. (25 ft. 5 in.).
Height 2.10 m. (6 ft. 10½ in.).

Weights and Loading (AVD-12).—
Weight empty 715 kg. (1,576 lb.).
Normal loaded weight 1,050 kg. (2,310 lb.).
Max. permissible loaded weight 1,100 kg. (2,425 lb.).



The AISA AVD-12C (225 h.p. Continental O-470-A engine).

Tail Unit.—Cantilever monoplane type. Structure and tab arrangements as for I-11. Areas: fin 0.65 m.² (6.9 sq. ft.), rudder 0.55 m.² (5.9 sq. ft.), tailplane 1.56 m.² (16.7 sq. ft.), elevators 1.02 m.² (10.9 sq. ft.). Span of tailplane 3.2 m. (10 ft. 6 in.).

Landing Gear.—Fixed tail-wheel type. Oil/spring shock-absorbers. Hydraulic wheel brakes. Tail-wheel is linked to rudder-bar but may be disconnected at will by pilot.

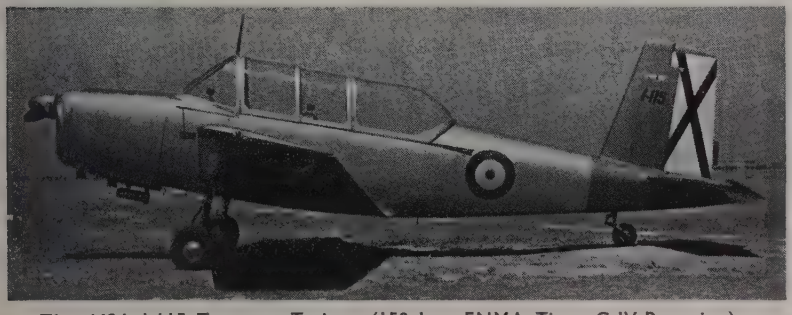
Power Plant.—One 150 h.p. ENMA Tigre G-IV-B four-cylinder in-line inverted air-cooled engine. ENHASA P8 two-blade metal airscrew with pitch adjustable on ground. Two fuel tanks in wings. Total fuel capacity 135 litres (30 Imp. gallons).

Accommodation.—Tandem cockpits under continuous canopy with sliding section over each cockpit. Complete dual controls and instrumentation. Equipment includes Iberavia ITR 6 radio transmitter/receiver and Marconi artificial horizon. Small baggage compartment behind rear seat accessible from outside.

Dimensions.—
Span 9.54 m. (31 ft. 3 in.).
Length 7.35 m. (24 ft. 1 in.).
Height 2.10 m. (6 ft. 10 in.).

Weights and Loadings (Two-seater).—
Weight empty 612 kg. (1,346 lb.).
Weight loaded 900 kg. (1,980 lb.).
Wing loading 64.3 kg./m.² (13.18 lb./sq. ft.).
Power loading 5.06 kg./h.p. (11.13 lb./h.p.).

Performance (two-seater, fully loaded).—
Max. speed 240 km.h. (149 m.p.h.).
Cruising speed 204 km.h. (126.6 m.p.h.).
Landing speed with flaps 81.5 km.h. (50.6 m.p.h.).
Initial rate of climb 225 m./min. (686 ft./min.).
Service ceiling 4,400 m. (14,430 ft.).
Take-off distance to 15 m. (50 ft.) 380 m. (415 yds.).
Landing distance from 15 m. (50 ft.) 350 m. (382 yds.).
Duration (70% power) 3½ hours.



The AISA I-115 Two-seat Trainer (150 h.p. ENMA Tigre G-IV-B engine).

Wing loading 58.33 kg./m.² (11.95 lb./sq. ft.).

Weights and Loading (AVD-12C).—
Weight empty 755 kg. (1,664 lb.).
Normal loaded weight 1,230 kg. (2,712 lb.).
Max. loaded weight 1,300 kg. (2,866 lb.).
Wing loading 72.22 kg./m.² (14.8 lb./sq. ft.).

Performance (AVD-12).—
Max. speed 225 km.h. (140 m.p.h.).
Cruising speed (75% power) 195 km.h. (121 m.p.h.).
Min. speed 65 km.h. (40.5 m.p.h.).
Initial rate of climb (at normal A.U.W.) 258 m./min. (850 ft./min.).
Time to 1,000 m. (3,280 ft.) 4 min. 18 sec.
Time to 3,000 m. (9,850 ft.) 17 min. 19 sec.
Time to 5,000 m. (16,400 ft.) 42 min. 3 sec.
Service ceiling 5,400 m. (17,700 ft.).
Max. range 950 km. (560 miles).
Max. endurance 4.5 hours.

Performance (AVD-12C).—
Max. speed 278 km.h. (173 m.p.h.).
Cruising speed (75% power) 267 km.h. (166 m.p.h.).
Min. speed 70 km.h. (43.5 m.p.h.).
Initial rate of climb (at normal A.U.W.) 360 m./min. (1,180 ft./min.).
Time to 1,000 m. (3,280 ft.) 3 min.
Time to 3,000 m. (9,850 ft.) 11 min.
Time to 5,000 m. (16,400 ft.) 26 min. 10 sec.
Service ceiling 6,400 m. (21,000 ft.).
Max. range 1,000 km. (621 miles).
Max. endurance 4 hr. 10 min.

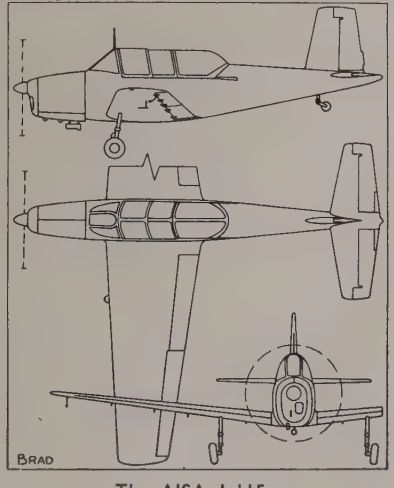
THE AISA I-115.

The first prototype I-115 flew for the first time on June 20, 1952. Under the military designation E.9, this aircraft is being built in series for the Spanish Air Force.

Type.—Two-seat Primary or single-seat Aerobatic Trainer.

Wings.—Low-wing cantilever monoplane. NACA 23015/23009 wing section. Chord 1.96 m. (6 ft. 5 in.) at root, 0.98 m. (3 ft. 2 in.) at tip. Dihedral 6°. Incidence 3°. Single-piece two-spar all-wood structure with stressed plywood skin. Slotted flaps and differentially-operated ailerons have plywood frames and leading-edges and overall fabric covering. Ailerons droop when flaps lowered. Total area of flaps 1.59 m.² (17.1 sq. ft.). Total area of ailerons 1.19 m.² (12.8 sq. ft.). Gross wing area 14.0 m.² (150.6 sq. ft.).

Fuselage.—All-wood monocoque structure.



The AISA I-115.

THE AISA I-11B.

The prototype I-11 had a tricycle landing-gear and first flew in 1950. The I-11B, with tail-wheel landing-gear, was developed in response to the request of would-be owners for a traditional layout, and the prototype of this version flew on October 16, 1953. The first 70 production I-11B's have only basic flying instruments; the second series of 110 aircraft have a full blind-flying panel.

Type.—Two-seat touring or training monoplane. Fully-aerobatic when flown as a single-seater.

Wings.—Low-wing cantilever monoplane. NACA 23015/23009 wing section. Root chord 1.74 m. (5 ft. 8 in.), tip chord 1.14 m. (3 ft. 9 in.). Dihedral 7°. Incidence 3°. Two-spar wood structure with plywood skin. Differentially-operated ailerons have wood frames and leading-edge and overall fabric covering. Two-position flaps between ailerons and fuselage. Total flap area 1.4 m.² (15 sq. ft.). Total aileron area 1.116 m.² (11.6 sq. ft.). Gross wing area 13.4 m.² (144 sq. ft.).

Fuselage.—All-wood monocoque structure.

Tail Unit.—Cantilever monoplane type. Fixed surfaces have two spars and plywood skin. Movable surfaces have wood frames and leading-edges with a fabric covering. Single-piece elevator has semi-automatic trim-tabs. Rudder tab adjustable on ground only. Areas: fin 0.629 m.² (6.76



The AISA I-11B (90 h.p. Continental C90 engine).

sq. ft.), rudder 0.475 m.² (5.11 sq. ft.), tailplane 1.595 m.² (17.16 sq. ft.), elevator 0.894 m.² (9.62 sq. ft.). Span of tailplane 3.04 m. (10 ft.).

LANDING GEAR.—Fixed tail-wheel type. Oil/spring shock-absorbers. Hydraulic wheel-brakes. Steerable tail-wheel. Track 2.70 m. (8 ft. 10 in.).

POWER PLANT.—One 90 h.p. Continental C90-12F four-cylinder horizontally-opposed air-cooled engine driving a two-blade Aeromatic or fixed-pitch wood airscrew. Total fuel capacity 80 litres (17.6 Imp. gallons).

ACCOMMODATION.—Two side-by-side seats with dual controls under "blister" type canopy. Baggage space aft of seats.

DIMENSIONS.—
Span 9.340 m. (30 ft. 7 in.).
Length 6.468 m. (21 ft. 3 in.).
Height (tail down) 1.900 m. (6 ft. 3 in.).

WEIGHTS AND LOADINGS.—
Weight empty 421 kg. (926 lb.).
Normal loaded weight 644 kg. (1,417 lb.).
Max. permissible weight (semi-aerobatic category) 670 kg. (1,474 lb.).
Max. permissible weight (full aerobatic category) 570 kg. (1,254 lb.).
Normal wing loading 48 kg./m.² (9.84 lb./sq. ft.).
Normal power loading 7.15 kg./h.p. (15.7 lb./h.p.).

PERFORMANCE (at normal loaded weight).—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 177 km.h. (110 m.p.h.).
Min. speed 76 km.h. (47.2 m.p.h.).
Rate of climb at S/L. 220 m./min. (726 ft./min.).
Service ceiling 4,700 m. (15,415 ft.).
Range 650 km. (403 miles).

CASA



A line-up of CASA-1.131-L (Bücker Jungmann licence) Primary Trainers.

CONSTRUCCIONES AERONAUTICAS S.A.

HEAD OFFICE: CALLE DEL REY FRANCISCO No. 4, MADRID.

WORKS: MADRID, GETAFE, SEVILLE AND CADIZ.

President: Don Victor Chavarri Anduiza.

Counsellor-Deputy: Don José Ortíz Echagüe.

Managing Director: Don Francisco Díaz Iboléon.

Consulting Engineer: Don Francisco Lozano Aguirre.

Engineer in charge of Projects: Don Pedro Huarte-Medicoa Larraga.

Engineer in charge of Production: Don Eugenio Aguirre Castillo.

Engineer in charge of Administration: Don Emilio de la Guardia Ruiz.

This important concern has four factories wherein are built various types of all-metal military aircraft of national and foreign design for the Spanish Air Force.

At Seville, 200 Heinkel He. 111 aircraft, built by CASA as the CASA-2.111, are being completed for the Spanish Air Force in day bomber, reconnaissance bomber, trainer and command transport versions, with Rolls-Royce Merlin engines.

The last 50 of a large number of Bücker Jungmann biplane trainers built by CASA were also delivered during 1957. These aircraft are designated CASA-1.131-L.

In 1949, CASA completed the first twin-engined aircraft of Spanish design, the CASA-201, and the airframes for a series of 112 production aircraft have been completed at the Getafe factory.

The prototype of a second twin-engined aircraft of the firm's own design, the CASA-202, flew for the first time in May, 1952, and production of 20 of these aircraft is nearing completion, also at Getafe.

The company's latest product is the twin-engined 30/38 passenger airliner known as the CASA-207. This aircraft made its first flight in September, 1955 and a pre-series of 10 is now being built.

A development of the CASA-207 with turboprop engines is being built by Hamburger Flugzeugbau in Germany under the designation of HFB-209.

CASA has also begun the IRAN (Inspect and Repair As Necessary) overhaul of F-86F Sabre aircraft for the Spanish Air Force, under a Technical Assistance Agreement with North American Aviation Inc. Initial contracts covered the overhaul of 155 aircraft of which 40 had been delivered by February, 1957, with the remainder due to follow later in the year.

THE CASA-201 ALCOTAN.

The CASA-201, which flew for the first time in February, 1949, was the first twin-engined aircraft of original Spanish design and construction.

Several versions of the CASA-201 now being developed have the following designations and functions:—

201-A. Passenger version. Two Armstrong Siddeley Cheetah 27 engines.

201B. Passenger version. Two ENMA Sirio-VII-A engines.

201-D. Navigation, Radio, Multi-engine and Blind-flying training aircraft. Two Armstrong Siddeley Cheetah 27 engines.

201-E. Bombing and Photographic Training aircraft. Two Armstrong Siddeley Cheetah 27 engines.

201-F and G. Same as 201-D and E, but with two ENMA Sirio-VII-A engines.

201-H. Passenger version. Two Alvis Leonides 503/7 engines.

All of the airframes for the 112 aircraft on order have been completed, and it



A CASA-2.111 Bomber (Heinkel He 111 produced under licence).



The CASA-201 Alcotan Airliner (two 500 h.p. ENMA Sirio VIIA engines).

is expected that the Sirio will be the standard engine for these. One aircraft has been fitted experimentally with two 450 h.p. Pratt and Whitney Wasp Junior engines.

TYPE.—Twin-engined Light Transport.

WINGS.—Low-wing cantilever monoplane. Wing in three sections comprising centre-section and two tapering outer sections set at 6° dihedral. All-metal two-spar structure. Hydraulically-operated flaps inboard of ailerons, the latter being interconnected with the flaps and arranged to droop to augment flap area for landing. Wing area 41.80 m.² (450 sq. ft.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal tailplane and fin, metal-framed fabric-covered rudder and elevators.

LANDING GEAR.—Retractable tail-wheel type. Hydraulic operation.

POWER PLANT.—Two Armstrong Siddeley Cheetah 27 seven-cylinder radial air-cooled engines, each with a normal rated output of 385 h.p. and with 475 h.p. available for take-off, or two ENMA Sirio-VIIA seven-cylinder radial engines, each with a normal rated output of 440 h.p. and with 500 h.p. available for take-off, or two Alvis Leonides 503/7 nine-cylinder radial air-cooled engines, each with 520/540 h.p. available for take-off. Fuel tanks in wings.

ACCOMMODATION.—Crew of two and ten passengers. Cabin heating. Night-flying equipment.

DIMENSIONS.—
Span 18.40 m. (60 ft. 4 in.).
Length 13.80 m. (45 ft. 3 in.).
Height 3.85 m. (12 ft. 8 in.).

WEIGHTS AND LOADINGS (Cheetah engines).—
Weight empty 3,560 kg. (7,830 lb.).
Weight loaded 5,100 kg. (11,230 lb.).
Wing loading 122 kg./m.² (25 lb./sq. ft.).
Power loading 5.37 kg./h.p. (11.8 lb./h.p.).

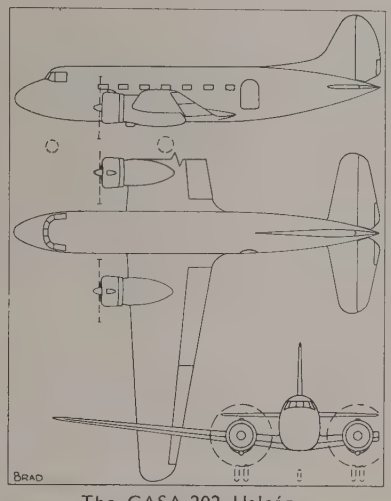
WEIGHTS AND LOADINGS (Sirio engines).—
Weight empty 3,600 kg. (7,920 lb.).
Weight loaded 5,500 kg. (12,100 lb.).
Wing loading 131 kg./m.² (26.8 lb./sq. ft.).
Power loading 6.11 kg./h.p. (13.5 lb./h.p.).

PERFORMANCE (Cheetah engines).—
Max. speed 325 km.h. (203 m.p.h.).
Landing speed 112 km.h. (70 m.p.h.).
Service ceiling 5,600 m. (18,370 ft.).
Range 1,000 km. (621 miles).
Duration 4 hours.

PERFORMANCE (Sirio engines).—
Max. speed 350 km.h. (219 m.p.h.).
Landing speed 117 km.h. (73 m.p.h.).
Service ceiling 6,100 m. (20,000 ft.).
Range 1,000 km. (621 miles).
Duration 4 hours.

THE CASA-202 HALCÓN.

The first prototype of this aircraft flew in May, 1952, with ENMA Beta engines, and a pre-series of 20 is nearing completion for the Spanish Government. A second prototype, flown at the beginning of 1956, has two Wright Cyclone R-1830 engines. The CASA-202 was designed in accordance with British Airworthiness requirements.



The CASA-202 Halcón.

The following data apply to the standard version with ENMA Beta engines :—

TYPE.—Twin-engined Transport.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23018 at root, 23009 at tip. Aspect ratio 8.11. Dihedral 6°. Chord 4.1 m. (13 ft. 5 in.) at root, 1.3 m. (4 ft. 3 in.) at tip. All-metal two-spar structure. Metal-framed fabric-covered ailerons. Total area of ailerons 4.4 m.² (47.3 sq. ft.). All-metal trailing-edge flaps. Total area of flaps 6.8 m.² (73.2 sq. ft.). Gross wing area 57.40 m.² (617.6 sq. ft.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal fin and tailplane, metal-framed fabric-covered rudder and elevators. Areas: fin 2.8 m.² (30.1 sq. ft.), rudder 2.3 m.² (24.7 sq. ft.), elevators (total) 4.7 m.² (50.6 sq. ft.), tailplane 7.7 m.² (82.9 sq. ft.).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic operation. Oleo shock-absorbers. Dual main wheels. Hydraulic brakes. Track 5.172 m. (16 ft. 11½ in.). Wheelbase 4.90 m. (16 ft. 1 in.).

POWER PLANT.—Two ENMA Beta 9C-29-750 nine-cylinder radial air-cooled engines, each with normal rating of 750 h.p. and with 775 h.p. available for take-off, or two Wright Cyclone R-1820-56 engines, developing 1,200 h.p. each at take-off. Fuel tanks in wings, two in centre-section of 530 litres (116 Imp. gallons) each, and two in outer wings of 540 litres (119 Imp. gallons) each. Total fuel capacity 2,140 litres (470 Imp. gallons).

ACCOMMODATION.—Crew of three and fourteen passengers. Cabin heated and air-conditioned. Night flying equipment.

DIMENSIONS.—
Span 21.58 m. (70 ft. 9 in.).
Length 16.0 m. (52 ft. 6 in.).
Height 3.81 m. (12 ft. 6 in.).



The CASA-202 Halcón Airliner (two 775 h.p. ENMA Beta engines).



The CASA-207 Azor Airliner (two 2,040 h.p. Bristol Hercules 730 engines).

WEIGHTS AND LOADINGS (ENMA Beta engines).—
Weight empty 5,267 kg. (11,615 lb.).
Max. disposable load 2,483 kg. (5,475 lb.).
Weight loaded 7,750 kg. (17,090 lb.).
Wing loading 135 kg./m.² (27.67 lb./sq. ft.).

PERFORMANCE (ENMA Beta engines).—
Max. speed at S/L. 310 km.h. (192.5 m.p.h.).
Max. speed at 2,840 m. (9,315 ft.) 370 km.h. (230 m.p.h.).
Cruising speed (70% power) 330 km.h. (205 m.p.h.).
Landing speed 117 km.h. (72.6 m.p.h.).
Service ceiling 7,300 m. (23,950 ft.).
Service ceiling on one engine 3,000 m. (9,840 ft.).

PERFORMANCE (Cyclone 1820-56 engines at A.U.W. of 8,250 kg.=18,200 lb.).—
Max. speed at 760 m. (2,500 ft.) at 2,500 r.p.m. 395 km.h. (245 m.p.h.).
Cruising speed at 3,000 m. (9,850 ft.) at 2,200 r.p.m. 370 km.h. (230 m.p.h.).
Stalling speed, flaps down 125 km.h. (78 m.p.h.).
Single-engine ceiling 4,200 m. (13,800 ft.).

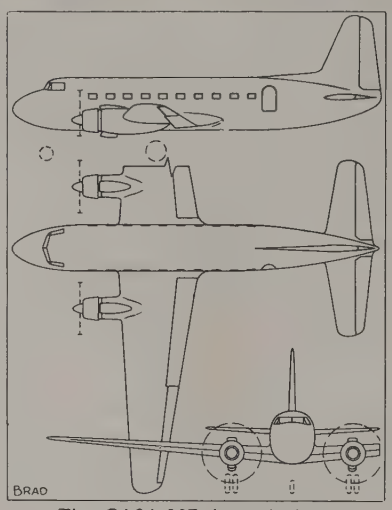
THE CASA-207 AZOR.

TYPE.—Twin-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23018 at root, NACA 23010 at tip. Aspect ratio 9. Chord 4.65 m. (15 ft. 3 in.) at root, 1.54 m. (5 ft. 1 in.) at tip. Dihedral 4°. Incidence 4°. All-metal two-spar structure. Metal framed fabric-covered ailerons. Hydraulically-operated all-metal trailing-edge flaps inboard of ailerons, the latter arranged to droop to augment flap area. Total aileron area 5.95 m.² (64 sq. ft.). Total flap area 11.67 m.² (125.6 sq. ft.). Gross wing area 85.8 m.² (923.2 sq. ft.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal fin and tailplane, metal-framed fabric-covered rudder and elevators. Areas: fin 6.34 m.² (68.2 sq. ft.), rudder 4.08 m.² (43.9 sq. ft.), tailplane 13.86 m.² (149.1 sq. ft.), elevators 6.26 m.² (67.4 sq. ft.). Tailplane span 10.0 m. (32 ft. 10 in.).



The CASA-207 Azor Airliner.

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Dual main wheels. Hydraulic brakes. Wheelbase 6.155 m. (20 ft. 2 in.). Track 6.883 m. (22 ft. 7 in.).

POWER PLANT.—Two 2,040 h.p. Bristol Hercules 730 fourteen-cylinder sleeve-valve air-cooled engines, or two Pratt & Whitney R-2800 eighteen-cylinder radial air-cooled engines. D.H. 4/4000/C constant-speed airscrews. Fuel tanks in wings, two in centre-section (985 litres=217 Imp. gallons each) and two in inner wing panels (550 litres=121 Imp. gallons each). Total fuel capacity 3,070 litres (676 Imp. gallons). Oil capacity 140 litres (30 Imp. gallons) in two tanks.

ACCOMMODATION.—Crew of 4 and 30-40 passengers. Cabin heated and air-conditioned.

DIMENSIONS.—
Span 27.80 m. (91 ft. 1 in.).
Length 20.85 m. (68 ft. 5 in.).
Height 7.75 m. (25 ft. 5 in.).

WEIGHTS (Hercules 730 engines).—
Weight empty 9,882 kg. (21,789 lb.).
Crew 325 kg. (716 lb.).
Passengers 2,387 kg. (5,263 lb.).
Fuel and oil 1,790 kg. (3,946 lb.).
Freight and baggage 616 kg. (1,358 lb.).
Weight loaded 15,000 kg. (33,075 lb.).

PERFORMANCE (Hercules 730 engines).—
Max. speed at 1,525 m. (5,000 ft.) 450 km.h. (280 m.p.h.).
Cruising speed at 3,050 m. (10,000 ft.) 350 km.h. (217 m.p.h.).
Stalling speed (with flaps) 140 km.h. (87 m.p.h.).
Service ceiling 8,800 m. (28,900 ft.).
Range (with crew of 4, 30 passengers and 15 kg.=33 lb. of baggage per passenger) 1,750 km. (1,100 miles).

PERFORMANCE (P. & W. R-2800 engines at A.U.W. of 17,000 kg.=37,500 lb.).
Max. speed at 2,600 m. (8,550 ft.) at 2,600 r.p.m. (3,600 h.p.) 465 km.h. (289 m.p.h.).
Cruising speed at 3,500 m. (11,500 ft.) 412 km./h. (256 m.p.h.) with 2,520 h.p. and 395 km.h. (245 m.p.h.) with 2,200 h.p.
Stalling speed, flaps down 145 km.h. (90 m.p.h.).
Single-engine ceiling 4,100 m. (13,500 ft.).
Still-air range (full payload) 1,950 km. (1,200 miles)

HISPANO

LA HISPANO-AVIACIÓN S.A.

HEAD OFFICE: AVENIDA DE JOSÉ ANTONIO 7, MADRID.

AIRCRAFT WORKS: CALLE SAN JACINTO 102-106, SEVILLE.

The controlling interest in Hispano-Aviacion, S.A. is held by Hispano Suiza S.A.

Production is centred mainly on the Messerschmitt Me 109 single-seat fighter, of which several new versions have been developed by Hispano since the war. In addition, the company has flown prototypes of an advanced trainer, designated the HA-100, and this aircraft has been ordered into production for the Spanish Air Force.

The HA-100 was designed under the direction of Professor Willi Messerschmitt, as was the new HA-200 advanced trainer, which is the first Spanish jet-propelled aircraft. Prototypes of the HA-200 are under evaluation.

Hispano are also developing a new liaison aircraft designated the HA-231, based on the design of the HA-200.

THE HISPANO HA-231-R1 GUIÓN.

Based on the design of the HA-200 Saeta, but modified extensively, the HA-231 is reported to be under development in two forms, as a six-seat liaison aircraft and as a side-by-side two-seat basic trainer.

It will be a low-wing monoplane, powered by two 400 kg. (880 lb.) s.t. Turbomeca Marboré II turbojet engines, and the liaison version will have three pairs of seats in tandem. No further details are available.

THE HISPANO BUCHÓN.

This aircraft is the Messerschmitt Me 109G built in Spain by Hispano and re-engined with Hispano HS-12Z and Rolls-Royce Merlin engines.



The Hispano HA-1109M-1-L Buchón (1,400 h.p. Rolls-Royce Merlin engine).



The Hispano HA-1110K-1-L Buchón Two-seat Fighter Trainer (1,300 h.p. Hispano HS-12Z-17 engine).

The Spanish Air Force bought 45 Me 109B (Spanish Air Force designation C-4) fighters from Germany in 1937, followed by 15 Me 109E's (C-5), 10 Me 109F's (C-10) and 25 Me 109G's (C-12). When supply from Germany ceased, production was begun in Spain, and the following versions have been built :—

HA-1109J-1-L. First Spanish-built version of Me 109G, with Hispano HS-12Z-89 engine. Prototype flew March 2, 1945. Twenty-five built. Withdrawn from service in July, 1947.

HA-1109K-1-L. Production version with 1,300 h.p. Hispano HS-12Z-17 engine driving three-blade de Havilland Type PD63/355/1 airscrew. Intended to have machine-gun armament, but delivered without guns. First production HA-1109-K-1-L flown May, 1951. About 200 built, many of which are now being re-engined with Merlins.

HA-1109M-1-L. Similar to HA-1109K-1-L, but with 1,400 h.p. Rolls-Royce Merlin 500-45 engine driving four-blade Rotol Type E116/4F5/12 airscrew. Unarmed. Superseded the "K" in production when supply of Hispano engines ceased. Two prototypes had extended tailwheel leg.

HA-1109M-2-L. Variant of M-1-L with two 12.7 mm. CETME machine-guns in wings and rails for eight 10 kg. (22 lb.) rockets.

HA-1109M-3-L. Variant of M-1-L with rails for eight 10 kg. (22 lb.) rockets, but no guns.

HA-1110K-1-L. Two prototypes of a two-seat trainer version of the HA-1109K-1-L were built under this designation. No production is contemplated. First prototype flew in October, 1953.

HA-1111 K-1-L. Proposed development of HA-1110K-1-L with wing-tip fuel tanks.

HA-1112K-1-L. HA-1109K-1-L rearmed with two wing-mounted 20 mm. guns and under-wing launching rails for a total of eight 10 kg. (22 lb.) Oerlikon air-to-ground rockets. Modified camber-changing flaps.

HA-1112M-1-L. Current production version. Similar to HA-1109M-1-L, but with armament of two wing-mounted 20 mm. Hispano HS-404 cannon and under-wing launching rails for a total of eight 10 kg. (22 lb.) Oerlikon rockets. Modified camber-changing flaps.

A full structural description of the basic Me 109 has appeared in earlier editions of "All the World's Aircraft."

The following specification details apply to the production HA-1109M-1-L :—

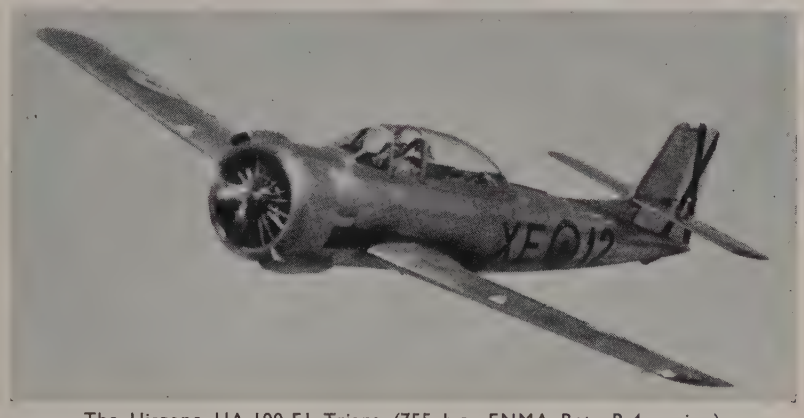
DIMENSIONS.—
Span 9.93 m. (32 ft. 7 in.).
Length 9.04 m. (29 ft. 7 in.).
Height 2.59 m. (8 ft. 6 in.).

WEIGHTS.—
Weight empty 2,445 kg. (5,390 lb.).
Weight loaded 2,858 kg. (6,300 lb.).

PERFORMANCE.—
Max. speed at 3,720 m. (12,200 ft.) 666 km.h. (414 m.p.h.).
Cruising speed 605 km.h. (376 m.p.h.).
Landing speed 180 km.h. (112 m.p.h.).
Max. rate of climb at 2,775 m. (9,100 ft.) 670 m./min. (2,200 ft./min.).
Service ceiling 10,200 m. (33,500 ft.).
Range 652 km. (405 miles).

THE HISPANO HA-100 TRIANA.
Spanish Air Force designation: E-12.

First post-war Hispano aircraft designed under the direction of Professor Willi Messerschmitt, the HA-100 is intended to replace the Spanish Air Force's HS-42 and HA-43 advanced trainers. Four prototypes were built, as follows :—



The Hispano HA-100-E1 Triana (755 h.p. ENMA Beta B-4 engine).

HA-100-E1. Two prototypes with 755 h.p. ENMA Beta B-4 engine, driving either Rotol three-blade or de Havilland four-blade airscrew. First flight December 10, 1954.

HA-100-F1. Two prototypes with 800 h.p. Wright Cyclone 957C7BA1 engine, driving Aeroproducts two-blade Type A-422-E1 airscrew.

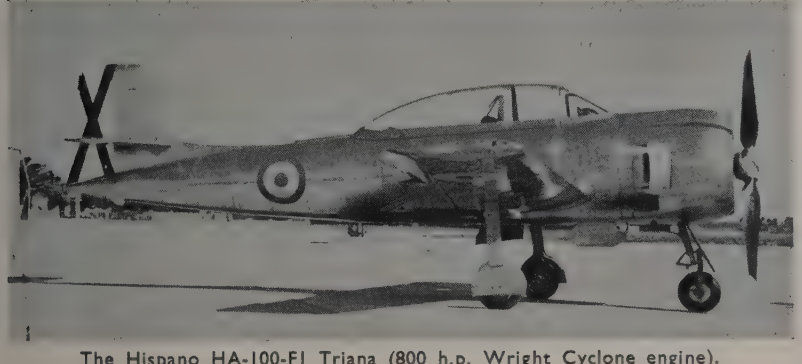
The HA-100-E1 has been ordered for service with the Spanish Air Force and the following data refers specifically to this version, although the HA-100-F1 is generally similar :—

TYPE.—Two-seat Advanced Flying and Armament Trainer.

WINGS.—Low-wing cantilever monoplane. 63_2A015, 64_2A015, 63_2A013 and 64_2A013 wing sections. Aspect ratio 6.25. Chord 1.985 m. (6 ft. 6 in.) at root, 1.274 m. (4 ft. 2 in.) at tip. Dihedral 5°. Incidence 4°. Single spar duralumin and Alclad structure. All-metal flaps. All-metal statically and aerodynamically balanced ailerons. Total area of flaps 2.275 m.² (24.5 sq. ft.). Total aileron area 1.456 m.² (15.6 sq. ft.). Gross wing area 17.35 m.² (186.6 sq. ft.).

FUSELAGE.—Circular section semi-monocoque structure of duralumin and Alclad.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas : fin 2.0 m.² (21.53 sq. ft.), rudder 0.68 m.² (7.3 sq. ft.), tailplane 3.14 m.² (33.5 sq. ft.), elevators 0.94 m.² (9.95 sq. ft.). Tailplane span 3.60 m. (11 ft. 9½ in.).



The Hispano HA-100-F1 Triana (800 h.p. Wright Cyclone engine).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Hydraulic shock-absorbers. Dunlop wheels, tyres and hydraulic brakes. Track 2.12 m. (6 ft. 11 in.). Wheelbase 1.652 m. (5 ft. 5 in.).

POWER PLANT.—One 755 h.p. ENMA Beta B-4 nine-cylinder radial air-cooled engine. de Havilland 4/2000/40SAE four-blade constant-speed airscrew or Rotol R114/3-30-40 SEA/4 three-blade constant-speed airscrew. One fuel tank in fuselage (376 litres = 83 Imp. gallons) and two in wings (109 litres = 24 Imp. gallons each). Total fuel capacity 600 litres (132 Imp. gallons). Oil capacity 60 litres (13.2 Imp. gallons).

ACCOMMODATION.—Two seats in tandem under sliding two-section canopy. Dual controls and duplicated instrument panels.

ARMAMENT.—Two CETME 12.7 mm. machine-guns and racks for four 8 kg. rockets or 4 × 50 kg. bombs.

EQUIPMENT.—Complete instrumentation for blind flying training. VHF, radio compass and ILS. Oxygen equipment. Ciné camera. Vertical and oblique camera installation for reconnaissance training.

DIMENSIONS.—
Span 10.4 m. (34 ft. 1 in.).
Length 8.98 m. (29 ft. 5 in.).
Height 2.895 m. (9 ft. 9½ in.).

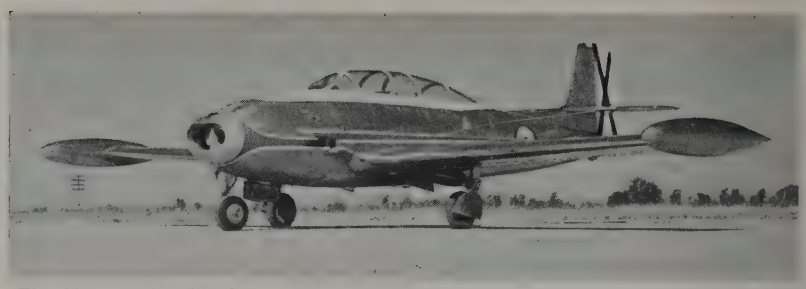
WEIGHTS.—
Weight empty 1,970 kg. (4,343 lb.).
Useful load 960 kg. (2,116 lb.).
Disposable load 650 kg. (1,433 lb.).
Weight loaded 2,930 kg. (6,459 lb.).

PERFORMANCE.—
Max. speed at 2,900 m. (9,500 ft.) 444 km.h. (276 m.p.h.).
Cruising speed (70% power) at 2,900 m. (9,500 ft.) 381.5 km.h. (237 m.p.h.).
Stalling speed 104 km.h. (64.5 m.p.h.).
Landing speed 128.2 km.h. (79.6 m.p.h.).
Initial rate of climb 650 m./min. (2,132 ft./min.).
Service ceiling 10,250 m. (33,620 ft.).
Range 1,323 km. (821 miles).
Endurance 3 hours, 28 mins.

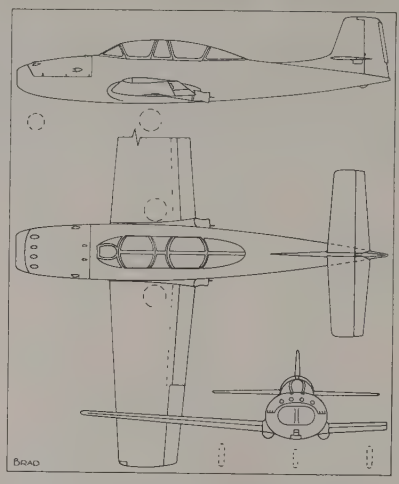
THE HISPANO HA-200-R1 SAETA.
Military designation: E-14.

Designed under the direction of Professor Willi Messerschmitt, the HA-200 uses many components of the HA-100, including the wings and rear fuselage. Two prototypes have been built, of which the first made its maiden flight on August 12, 1955.

TYPE.—Twin-jet Two-seat Advanced Flying and Armament Trainer.



The Hispano HA-200-R1 Saeta (two Turbomeca Marboré IIA turbojet engines).



The Hispano HA-200-R1 Saeta.

WINGS. Low-wing cantilever monoplane. Aspect ratio 6.22. Chord 1.985 m. (6 ft. 6 in.) at root, 1.274 m. (4 ft. 2 in.) at tip. Dihedral 3.5°. Incidence 4°. Single-spar structure of duralumin and Alclad. Split trailing-edge flaps. Statically and aerodynamically balanced all-metal ailerons. Total aileron area 1.0462 m.² (11.25 sq. ft.). Gross wing area 17.4 m.² (187.2 sq. ft.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Single spar variable-incidence tailplane, two-spar fin.

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Hydraulic shock-absorbers. Non-steering nose-wheel. Hispano wheels size 20 × 5.25 11 (main), 19 × 6.00 8 (nose). Tyre pressure 73 lb./sq. in. (main), 60 lb./sq. in. (nose). Hispano brakes. Wheelbase 2.45 m. (8 ft.). Track of main wheels 3.224 m. (10 ft. 7 in.).

POWER PLANT.—Two Turbomeca Marboré IIA turbojet engines (400 kg. = 880 lb. s.t. each) in fuselage with air inlet in nose and jet exits below trailing-edge of wing roots. Two fuel tanks in fuselage and two in wings. Total internal fuel capacity 745 litres (164 Imp. gallons). Two fixed wing-tip tanks 240 litres (53 Imp. gallons) capacity each, fitted with fuel jettison valves.

ACCOMMODATION.—Enclosed pressurised cabin seating two in tandem with dual controls. Heating and refrigeration equipment.

EQUIPMENT.—Complete blind-flying instrument equipment, VHF, radio compass, ILS, oxygen, etc. Armament appropriate to various training functions may be fitted.

DIMENSIONS.—
Span 10.42 m. (34 ft. 2 in.).
Length 8.88 m. (29 ft. 1½ in.).
Height 3.26 m. (10 ft. 8 in.).

WEIGHTS.—
Weight empty 1,677 kg. (3,697 lb.).
Useful load 1,496 kg. (3,298 lb.).
Disposable load 1,160 kg. (2,557 lb.).
Weight loaded 3,173 kg. (6,995 lb.).

PERFORMANCE.—
Max. speed at S/L. 652 km.h. (405 m.p.h.).
Max. speed at 9,000 m. (29,520 ft.) 700 km.h. (435 m.p.h.).
Initial rate of climb 1,020 m./min. (3,345 ft./min.).
Climb to 9,000 m. (29,500 ft.) 16 min.
Service ceiling 12,000 m. (39,360 ft.).
Cruising duration 3½ hours.
Cruising range 1,700 km. (1,056 miles) at 10,000 m. (32,800 ft.).

SWEDEN

SAAB

SVENSKA AEROPLAN A.B. (SAAB AIRCRAFT COMPANY).

HEAD OFFICE : LINKÖPING.
WORKS : LINKÖPING, JÖNKÖPING, TROLLHÄTTAN AND GOTHENBURG.
President : Tryggve Holm.

LINKÖPING DIVISION (SAAB-L).

Vice-President, Aeronautical Engineering : L. Brising.
Vice-President, Production : B. Johnson.
Vice-President, Finance : T. Arnheim.
Sales Manager : A. Rydberg.
Manager, Technical Service Department : C. Larsson.
Manager, Purchasing Department : U. Rydberg.

JÖNKÖPING DIVISION (SAAB-J).

(Aircraft apparatus and equipment)
Vice-President in charge : T. Faxén.

TROLLHÄTTAN DIVISION (SAAB-T).

(Motor cars, etc).
Vice-President in charge : Svante Holm.

The Saab Aircraft Company was founded at Trollhättan in 1937 for development and production of all-metal military aircraft. In 1939 Saab took over the Aircraft Division (ASJA) of the Svenska Järnvägsverkstäderna rolling stock factory in Linköping, which had been manufacturing and developing military and civil aircraft since 1930. In connection with the merger, Saab moved its head office and engineering departments to Linköping which has since become the company's main factory. In 1950, the company acquired a factory at Jönköping for development and manufacture of aircraft and related equipment. Other post-war expansions include a bomb-proof underground factory in Linköping, as well as important new production and engineering facilities in Linköping, Jönköping, Trollhättan and Gothenburg. The Gothenburg factory is producing components for the motor-car production at Trollhättan, which began in 1949-50, and which is now on a major scale.

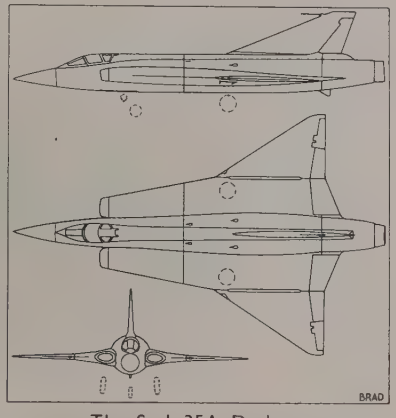
The capital of the company has been successively increased in connection with the large expansions that have taken place over the years, and now stands at Kr. 51,000,000. The Saab factories today employ approximately 7,600 people.

During World War II, the company supplied the Royal Swedish Air Force with large numbers of Saab-designed light bombers and fighters. In September, 1948, the first prototype of a swept-wing jet fighter, the Saab-29, made its maiden flight. The Saab-29 was the first swept-wing jet fighter to go into large-scale production and service in Western Europe and deliveries extended from May, 1951 until April, 1956.

The company is currently producing the Saab-32 Lansen, a two-seat transonic all-weather combat aircraft, deliveries of which began during the latter part of 1955.

In October, 1955 the first prototype of a new, single-seat all-weather supersonic fighter, the Saab-35 Draken (Dragon) made its maiden flight. This aircraft has now entered quantity production and will eventually replace the Saab-29 in service with the Royal Swedish Air Force units.

In the civil field, the company has designed and built the Saab-90 Scandia twin-engined 32-passenger airliner, which has been described fully in earlier editions of "All the World's Aircraft," and the Saab-91 Safir three or four-seat training and touring aircraft.



The Saab-35A Draken.

SAAB-35A DRAKEN.

Swedish Air Force designation: J35.

The Saab-35A Draken single-seat jet fighter, which has a high supersonic speed, has been designed mainly to intercept bombers in the transonic speed range, and carries full radar equipment to accomplish this under all weather conditions.

The Draken is of the "double delta" configuration, developed exclusively in Sweden, which provides relatively large space for fuel, armament and equipment in combination with low structure weight, low drag and a high air intake efficiency.

The first prototype of the Saab-35 made its maiden flight on October 25, 1955. During 1956 it was disclosed that the aircraft had gone into quantity production, and it will eventually replace the Saab-29 series in service with the Swedish Air Force.

Unconfirmed reports credit the Saab-35 with a top speed of approximately 1,600 km.h. (1,000 m.p.h.) or Mach 1.5.

TYPE.—Single-seat Supersonic All-weather fighter.

FUSELAGE.—All-metal structure, in front and rear main sections, connected to each other by a bolt joint. Fuselage front section integral with front of centre wing structure. Two pairs of air brakes, above and below rear fuselage.

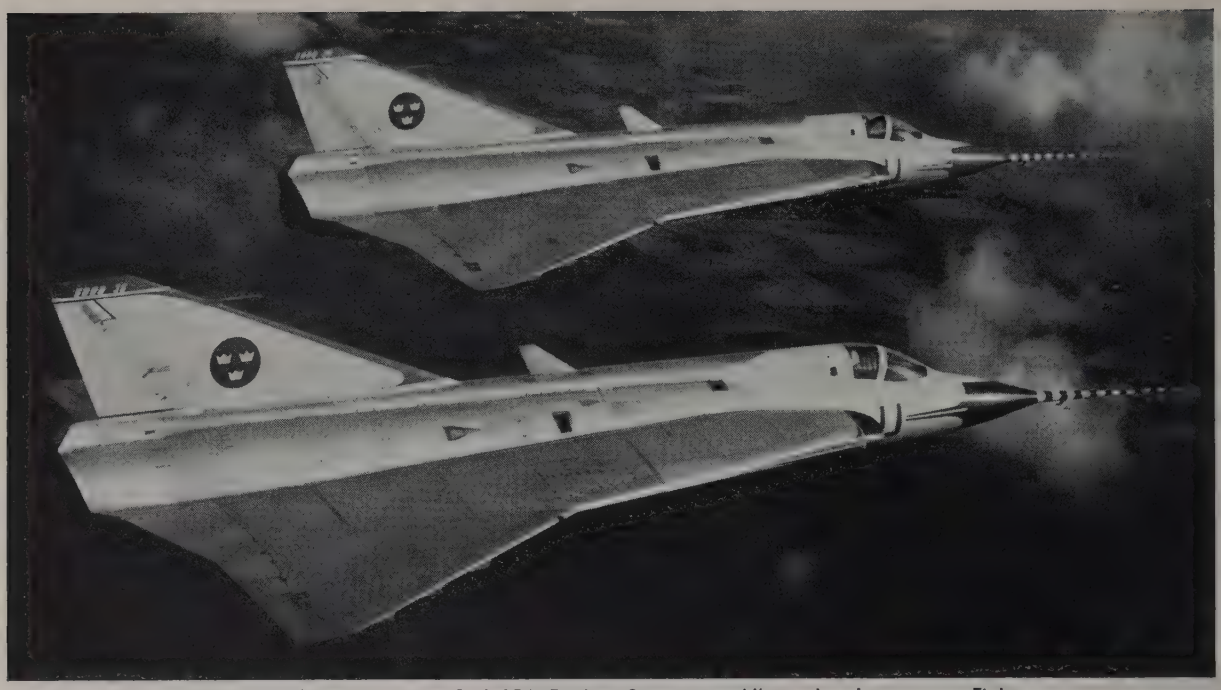
WINGS.—Cantilever "double delta" mid-wing monoplane. Sweepback on centre wing leading edge 80°, on outer wing leading edge 57°. Aspect ratio 1.77. Centre wing integral with fuselage. Outer wing, attached to centre wing with a bolt joint, has relatively thick skin sheet on a framework of spars and ribs. Wing area 50 m.² (538.2 sq. ft.).

CONTROL SURFACES.— Conventional delta-shape fin and rudder. Elevons on wing trailing edge comprise two inboard and two outboard surfaces, the latter being mass-balanced. All control surfaces servo-operated by two hydraulic tandem jacks each, fed by two separate hydraulic systems. No part of load on control surfaces is fed into stick and rudder pedals. Stick forces are generated by a unit which is sensitive to Mach number and to dynamic pressure. Three-axis Lear automatic flight control system.

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Main units retract outward, the legs shortening during retraction to reduce the space required



The three prototypes of the Saab-35A Draken, which is now in quantity production.



Two of the three prototype Saab-35A Draken Supersonic All-weather Interceptor Fighters.

inside wing. Nose-wheel retracts forward. Double-disc brakes and anti-skid brake regulators. Wheel track 2.7 m. (8 ft. 10½ in.).

POWER PLANT.—One Svenska Flygmotor (Rolls-Royce licence) Avon engine (Swedish Air Force designation : RM 6) with Swedish-developed afterburner. Internal fuel in integral tanks and fuselage bag tanks.

ACCOMMODATION.—Pressurised and air-conditioned cockpit, with fully-automatic Saab ejection seat.

ARMAMENT.—External armament in form of air-to-air missiles and rocket projectiles. Fixed large-bore cannon can be replaced by extra internal fuel tanks.

EQUIPMENT.—Complete radar equipment with nose scanner and pilot's scope, as well as fire control equipment.

DIMENSIONS.—
Span 9.4 m. (30 ft. 10 in.).
Length 14.2 m. (46 ft. 7 in.).

WEIGHT.—
Loaded weight (depending on armament) approx. 8,100-9,150 kg. (17,860-20,175 lb.).

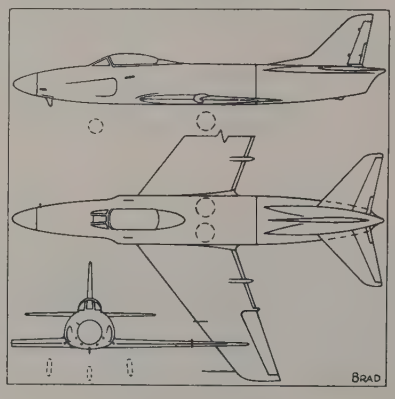
PERFORMANCE.—
No details available.

THE SAAB-32 LANSEN.

Royal Swedish Air Force designations: A32, J32 and S32.

The Saab-32 was designed and built for the Royal Swedish Air Force in accordance with a specification laid down by the Royal Swedish Air Board for an aircraft primarily intended for all-weather attack operations against ground and sea targets.

The first prototype of the Saab-32 made its first flight on November 3, 1952, powered by an early version of the British-built Rolls-Royce Avon axial-flow turbojet engine. The production A 32A, however is fitted with the Avon RA.7R with afterburner (Swedish Air Force designation RM 5) built under licence in Sweden by Svenska Flygmotor AB. of Trollhättan.



The Saab-32 Lansen.

During 1953 a Lansen prototype exceeded the speed of sound under complete control during dive tests, one of the first aircraft of its class in the World to do so.

The Lansen was ordered into quantity production in 1953, and the aircraft is now in large-scale service with the Swedish Air Force. The following versions have been announced :—

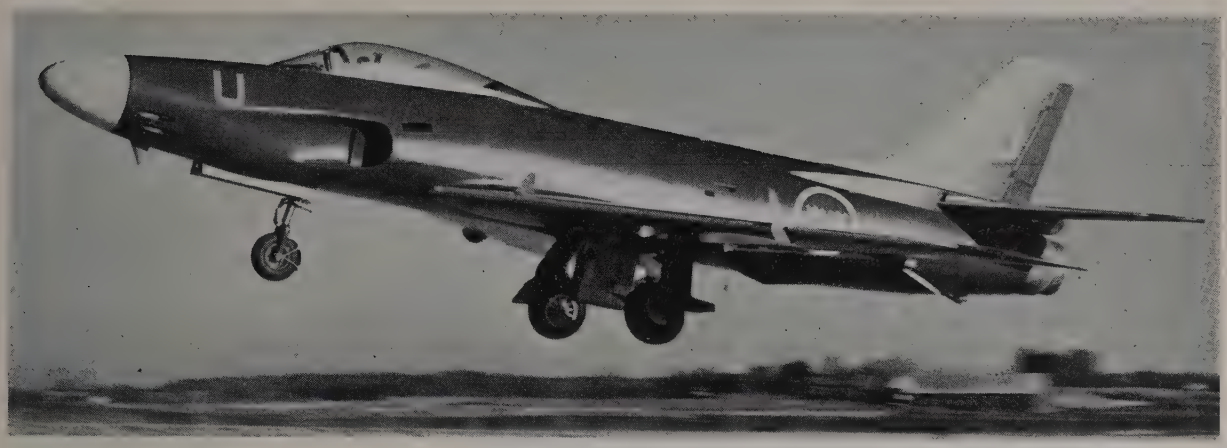
A 32A. First production version for all-weather attack duties. Deliveries began late in 1955.

J 32B. All-weather and night fighter version first flown on January 7, 1957. Differs from the A 32A mainly in having a considerably more powerful Svenska Flygmotor-built Avon engine (RM 6 in Sweden) fitted with an enlarged Swedish-developed afterburner, giving considerably increased rate of climb and speed. The J 32B also features a new and powerful armament, and a new navigation and fire control system.

S 32C. Photographic reconnaissance version, first flown on March 26, 1957. Fitted with the most modern photographic equipment, with provision for several alternative camera installations in modified nose. Special aids make possible night photography from a wide range of



The Saab A 32A Lansen Two-seat All-weather Fighter (Rolls-Royce Avon turbojet engine with afterburner).



The Saab J 32B, the Two-seat Night and All-weather Fighter version of the Lansen.

altitudes. Complete electronic equipment for night navigation and radar reconnaissance. Production of substantial number is under way.

The description below refers specifically to the A 32A all-weather attack version, but is also generally applicable to the J 32B and S 32C.

quickly removable for access to engine. Four air-brakes in rear fuselage sides.

TAIL UNIT.—Cantilever monoplane type. Movable tailplane mounted on big fairings used to smooth the airflow around the tailplane. Elevator operated by hydraulic booster system.

LANDING GEAR.—Retractable nose-wheel type. Hydraulically (Saab) retractable, design. The aircraft may be equipped with dual controls to facilitate crew training.

ARMAMENT.—Four 20 mm. cannon, bombs and rocket projectiles. The aircraft can also carry guided missiles.

DIMENSIONS.—
Span 13 m. (42 ft. 8 in.).
Length 14.65 m. (48 ft.).
Height 4.75 m. (15 ft. 6 in.).



The Saab S 32C Two-seat Photographic Reconnaissance version of the Lansen.

TYPE.—Two-seat All-weather Attack Fighter.

WINGS.—Swept low-wing cantilever monoplane with 35° sweep-back at 25% wing chord. Thin laminar-flow wing section. Aspect ratio 4.5. All-metal flush-riveted stressed skin structure. Ailerons operated by hydraulic booster system of Saab design. Fowler flaps. Two stall fences.

FUSELAGE.—All-metal structure with flush-riveted stressed skin. Entire rear fuselage main wheels into the fuselage, the nose wheel forwards. Goodyear wheels and brakes, with Dunlop Maxaret anti-skid device.

POWER PLANT.—One Svenska Flygmotor-built Rolls-Royce Avon RA.7R (Swedish designation RM 5) axial-flow turbojet engine. with re-heat installation. Air intakes in fuselage sides.

ACCOMMODATION.—Pressurized cockpit for pilot and observer. Ejector seats of Saab

WEIGHTS.—
Weight empty approx. 7,000 kg. (15,400 lb.).
Weight loaded approx. 10,000 kg. (22,000 lb.).

PERFORMANCE.—
Max. speed over 1,100 km.h. (700 m.p.h.).
Landing speed 200 km.h. (125 m.p.h.).
Service ceiling approx. 15,000 m. (49,200 ft.).



The Saab J 29F Single-seat Interceptor Fighter (Svenska Flygmotor RM2 Ghost 50 with afterburner).



The Saab J 29F Single-seat Interceptor Fighter (Svenska Flygmotor RM2 Ghost 50 with afterburner).

THE SAAB-29.
Royal Swedish Air Force designations: J 29, A 29 and S 29.

The Saab-29 was the first swept-wing jet fighter to be put into large-scale production in Western Europe. The first of three prototypes was test-flown on September 1, 1948, powered by a D.H. Ghost turbojet engine giving a static thrust of about 4,400 lb. (2,000 kg.). A series prototype made its first flight in July, 1950. All production aircraft are fitted with 5,000 lb. (2,270 kg.) static thrust Ghost engines built under licence in Sweden by Svenska Flygmotor AB (SFA) at Trollhättan. The Saab-29F version is also fitted with a Swedish-developed afterburner.

The Saab-29 series of day fighter, attack and photographic reconnaissance aircraft is in large-scale service with the Royal Swedish Air Force. The following versions of the Saab-29 have been built (only A.F. designations are used).—

J 29A. First production version. Initial aircraft featured wing air brakes, later aircraft fuselage-mounted air brakes. Deliveries started in May, 1951.

J 29B. Second production version with increased internal fuel tankage. Replaced the J 29A in production early in 1953.

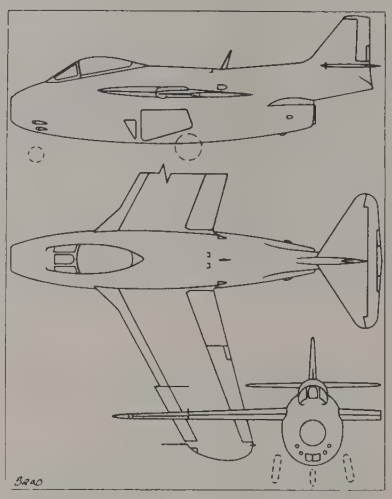
A 29. Attack version identical to the J 29B.

S 29C. Photographic reconnaissance version carrying up to six fully automatic cameras and improved navigation equipment. The prototype made its first flight in June, 1953. Deliveries started before the end of 1953.

J 29D. Experimental version fitted with afterburner developed by Royal Swedish Air Board and Svenska Flygmotor AB in collaboration. First flown in March, 1954.

J 29E. This version fitted with a modified outer wing giving higher critical Mach number and improved transonic flight characteristics. The new outer wing was first flight-tested in December, 1953, and has since been introduced on production aircraft.

J 29F. The fifth production version. The J 29F combines the improvements of the J 29E and the J 29D experimental



The Saab-29 (J 29F).

afterburner-equipped version. The introduction of an afterburner has approximately doubled the climb rate of the J 29F and considerably increased the service ceiling. The first pre-production J 29F made its first flight in the late summer of 1954. A considerable number of J 29B fighters are being brought up to J 29F standard. Deliveries of the J 29F started late in 1954 and this modification work was continued through 1957 although production of new J 29 aircraft ended in April, 1956.

The description below refers to the J 29B in general :—

TYPE.—Single-seat jet-propelled Interceptor (J 29), Ground Attack Fighter (A 29) and Photographic Reconnaissance monoplane (S 29).

WINGS.—Swept shoulder-wing cantilever monoplane with 25° sweep-back. Thin laminar-flow wing section. All-metal two-spar structure with flush-riveted stressed skin, partly of 75S alloy. Automatic leading-edge slots are light alloy castings. They are locked in closed position when landing flaps are up. Ailerons operated by hydraulic booster system of Saab design. Air brakes in the initial series were fitted to the wing behind the rear spar, but are fuselage-mounted in later aircraft. Gross wing area 258 sq. ft. (24.0 m.²).

FUSELAGE.—All-metal structure with flush-riveted stressed skin. Built in three sections. The straight central air duct is integral and stress-taking. Of generous cross-section, the fuselage houses the engine, landing-gear, fuel tanks, armament, etc.

TAIL UNIT.—Cantilever monoplane type. High-mounted tailplane is electrically adjustable in flight. Maximum angles +1°/—6°. The operating switch is on the pilot's stick. Two different setting speeds are available, the lower one for high-speed trimming giving a change in tailplane setting of about 1°/sec. The elevator has a mechanically operated trim-tab as an emergency precaution.

LANDING GEAR.—Retractable tricycle type. Hydraulically retracted, main wheels forward, nosewheel backwards, into the fuselage. Goodyear single-disc brakes. Designed for operation on grass airfields. Track 7 ft. 2 in. (2.2 m.).

POWER PLANT.—One Svenska Flygmotor (D.H. licence) Ghost 50 (Swedish Air Force designation : RM2) turbojet engine rated at 5,000 lb. (2,300 kg.) at 10,250 r.p.m. Engine mounted at three points on a strong fuselage frame. Engine cowling stressed for tail loads, removable in one piece. Swedish afterburner fitted in J 29F version.

ACCOMMODATION.—Pressurised pilot's cockpit ahead of wing leading-edge. Bullet-proof wind shield and sliding canopy, the latter jettisonable with gunpowder charge. Marshall cabin blower. Pilot's ejector seat of Saab design.

ARMAMENT.—Four 20 mm. cannon and an undisclosed number of rockets.

DIMENSIONS.—
Span 36 ft. 1 in. (11.0 m.).
Length 33 ft. 2½ in. (10.13 m.).
Height 12 ft. 3½ in. (3.75 m.).

WEIGHTS AND LOADING.—
Operating weight empty 4,300 kg. (9,479 lb.).
Normal take-off weight 6,060 kg. (13,360 lb.).
Wing loading 252 kg./m.² (51.6 lb./sq. ft.).

PERFORMANCE.—
Max. speed 1,060 km.h. (658 m.p.h.).
Max. range 2,700 km. (1,677 miles).
Take-off run to 15 m. (50 ft.) normal T.O. weight 900 m. (984 yds.).
Landing run from 15 m. (50 ft.) with flaps down (landing weight) 4,600 kg. (10,120 lb.) 900 m. (984 yds.).

THE SAAB-91A SAFIR.

The Safir, which first flew in 1945, was originally fitted with a 130 h.p. D.H. Gipsy Major IC engine. The production model, however, is powered with a later model D.H. Gipsy Major 10 of 145 h.p. Apart from being marketed in Sweden, the Safir has been exported to various parts of the World—Argentina, Brazil, Ethiopia, Holland, India, Norway, etc.

Experimental variants of the Safir have been fitted with swept wings for research purposes.

TYPE.—Three-seat Low-wing Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Single-spar structure in two detachable sections bolted to fuselage. Metal covering in front of spar and fabric aft. Aspect ratio 8.3; taper ratio 1 : 0.45. Wing area 146.3 sq. ft. (13.60 m.²). Ailerons have Alclad-structure with fabric covering. Trim-tab in port aileron adjustable on ground. Mechanically-operated all-metal split trailing-edge flaps between ailerons and fuselage.

FUSELAGE.—Monocoque structure with vertical frames, longitudinal stringers and stressed Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Alclad structure with metal skin over fixed surfaces and fabric covering to rudder and elevators. Controllable trim-tab in starboard elevator and adjustable balance tab in rudder.

LANDING GEAR.—Retractable tricycle-type. Main wheels, carried on oleo-spring shock-absorber legs, retract inwards into fuselage, and nose-wheel backwards into fuselage. Mechanical operation. Hydraulically-operated wheel-brakes controlled by toe-pedals.

POWER PLANT.—One 145 b.h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine driving two-blade airscrew. Fuel capacity 24 Imp. gallons (110 litres) with 5.5 Imp. gallons (25 litres) reserve.

ACCOMMODATION.—Enclosed cabin seating three, pilot (on port) and one passenger side-by-side in front with dual control and second passenger behind and on starboard side, with luggage compartment behind pilot. Two passenger seats may be replaced by stretcher or freight. Three hinged panels for access, which can be jettisoned in emergency. Cabin interior width 4 ft. 0 in. (1.22 m.).

DIMENSIONS.—
Span 34 ft. 9 in. (10.60 m.).
Length 25 ft. 7 in. (7.8 m.).
Height 7 ft. 3 in. (2.20 m.).



The Saab-91C Safir Four-seat Tourer (190 h.p. Lycoming engine).

WEIGHTS AND LOADINGS.—
Weight empty 1,278-1,344 lb. (580-610 kg.) according to equipment.
Disposable load 849-915 lb. (385-415 kg.).
Weight loaded 2,195 lb. (955 kg.).
Max. overload 2,370 lb. (1,075 kg.).
Wing loading (at normal loaded weight) 15 lb./sq. ft. (73.2 kg./m.²).
Power loading 15.66 lb./h.p. (7.1 kg./h.p.).

PERFORMANCE.—
Max. speed 164 m.p.h. (265 km.h.).
Max. cruising speed 154 m.p.h. (248 km.h.).
Economical cruising speed 146 m.p.h. (235 km.h.).
Stalling speed 53 m.p.h. (85 km.h.).
Rate of climb at sea level 985 ft./min. (300 m./min.).
Cruising range 585 miles (960 km.).

THE SAAB-91B SAFIR.

Royal Swedish Air Force designation: Sk 50.

This version of the Safir differs from the 91A mainly in having a 190 h.p. Lycoming O-435-A engine. The first prototype made its maiden flight on January 18, 1949.

In 1951, the Royal Swedish Air Force adopted the Saab-91B as a standard primary trainer and a considerable number was ordered. Owing to Saab's other military commitments, the production of these aircraft was subcontracted to the Dutch De Schelde factory at Dordrecht. Following increased production capacity at Saab's main plant in Linköping, Safir production was resumed in Sweden at the end of 1954.

The 91B may be equipped to carry two 8 mm. guns and eight 63 mm. rocket projectiles or training bombs. The Safir is now being used by the air forces of Sweden, Norway and Ethiopia, and has also attained a unique position as a trainer for the pilots of the following airlines—KLM, SABENA, Deutsche Lufthansa and Air France.

In the Swedish Air Force, pilots go direct from the Safir to an advanced jet trainer, at present the D. H. Vampire Trainer (J 28C).

POWER PLANT.—One 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine driving a Hartzell two-blade variable-pitch airscrew. Petal-type cowling. Fuel capacity 175 litres (38.5 Imp. gallons).

DIMENSIONS.—
Span 34 ft. 9 in. (10.6 m.).
Length 26 ft. (7.95 m.).
Height on ground 7 ft. 2 in. (2.2 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,590 lb. (720 kg.).
Weight loaded (Utility category) 2,686 lb. (1,215 kg.).
Weight loaded (Aerobatic category) 2,320 lb. (1,050 kg.).
Wing loading (Aerobatic) 15.8 lb./sq. in. (77.2 kg./m.²).
Power loading (Aerobatic) 12.2 lb./h.p. (5.53 kg./h.p.).

PERFORMANCE.—
Max. speed 171 m.p.h. (275 km./hr.).
Max. cruising speed 152 m.p.h. (245 km./hr.).
Econ. cruising speed at S/L. 144 m.p.h. (232 km./hr.).
Rate of climb at S/L. 1,140 ft./min. (5.8 m./sec.).
Service ceiling 20,500 ft. (6,250 m.).
Cruising range 670 st. miles (1,075 km.).



The Saab-91B Safir Trainer in the colours of the Royal Norwegian Air Force.

THE SAAB-91C SAFIR.

In September, 1953, a third version of the Safir made its first flight. The new version, which was later put into quantity production, is designated the Saab-91C and differs mainly from the three-seat 91B version in having comfortable accommodation for four people and luggage.

In addition to its use as a private, business, taxi and aerial mapping aircraft the 91C version can easily accommodate a stretcher case and a medical attendant, and by removing the rear seats a quarter-ton of cargo can be carried. It is also suitable for use as a trainer.

POWER PLANT.—
Same as for the Saab-91B.

DIMENSIONS.—
Same as for the Saab-91B.

WEIGHTS AND LOADINGS.—
Weight empty 745 kg. (1,650 lb.).
Weight loaded 1,215 kg. (2,686 lb.)
Wing loading 89.3 kg./m.² (18.2 lb./sq ft.).
Power loading 6.4 kg./h.p. (14.1 lb./h.p.).

PERFORMANCE.—
Max. speed 270 km.h. (168 m.p.h.).
Max. cruising speed 240 km.h. (150 m.p.h.).
Econ. cruising speed at S/L. 227 km.h. 141) m.p.h.).
Rate of climb at S/L. 4.25 m./sec. (840 ft./min.).
Service ceiling 5,100 m. (16,800 ft.).
Cruising range 960 km. (600 miles).

SWITZERLAND

THE FEDERAL AIRCRAFT FACTORY

EIDG. FLUGZEUGWERK — FABRIQUE FEDERALE D'AVIONS (Federal Aircraft Factory).

HEAD OFFICE AND WORKS: EMMEN, LUCERNE.
Director: M. Buri.

This official Government establishment manufactures aircraft for the Swiss Army Air Corps. It is not in a position to provide details of its current activities.

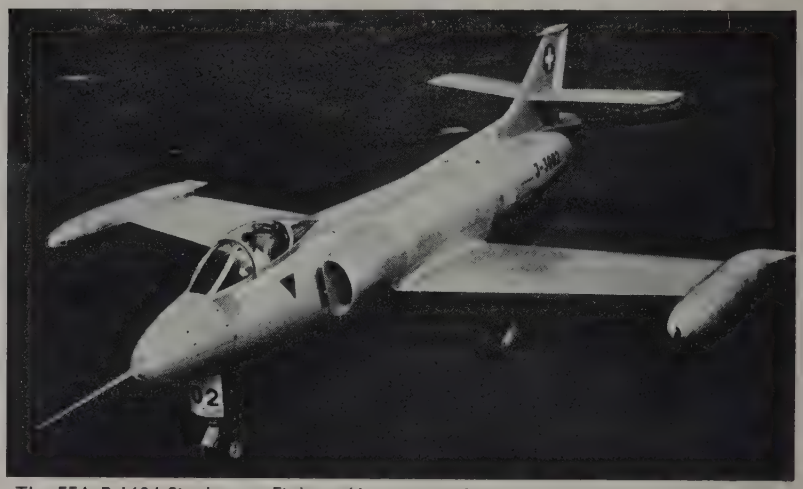
FFA

FLUG & FAHRZEUGWERKE A.G.

HEAD OFFICE AND WORKS: ALTENRHEIN BEI RORSCHACH.
President: Dr. Cl. Caroni.
Works Director: O. Eitel.
Chief Engineer, Aircraft Section: Dr. Ing. H. L. Studer.

This firm, formerly known as A.G. für Dornier-Flugzeuge was originally the Swiss branch of the German Dornier company. It is now entirely a Swiss company and builds aircraft for the Swiss Government only.

The company is now building Vampire and Venom wings and other components for the Swiss Government. It has completed the development and construction of a jet fighter of its own design known as the P-1604, details of which follow.

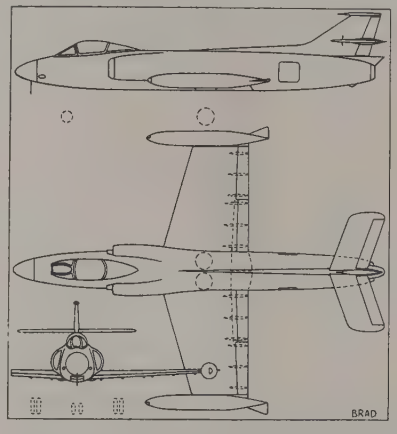


The FFA P-1604 Single-seat Fighter (Armstrong Siddeley Sapphire turbojet engine).

THE FFA P-1604.

The P-1604 single-jet fighter was designed to meet a Swiss Air Force specification for a single-seat aircraft primarily intended for ground attack operations carried out from short runways situated in narrow valleys at considerable altitudes above sea-level. The main requirements were, therefore, good high speed and climb performances, short landing and take-off distances, a small radius of turn and good low-speed behaviour.

The first prototype, known as the P-16 and powered by an Armstrong Siddeley Sapphire turbojet, made its first flight on April 28, 1955, and in preliminary trials it showed excellent flying qualities, especially in the low-speed range. It was subsequently destroyed in an accident. A second prototype, redesignated P-1604 and with numerous design changes, flew for the first time on June 16, 1956, and exceeded Mach 1 for the first time two months later. Two further prototypes and 36 production aircraft are scheduled for completion by the autumn of 1958.



The FFA P-1604 Fighter.

TYPE.—Single-seat Fighter.

WINGS.—Cantilever low-wing monoplane. Aspect ratio 4.5. Chord 3.50 m. (11 ft. 6 in.) at root, 2.15 m. (7 ft. 1 in.) at tip. T/C ratio approximately 4%. Dihedral approximately 3°. Sweepback 16° on leading-edge. All-metal structure with inner and outer skins and vertical shear webs. Ailerons operated through Jacottet-Leduc servo-controls. Fowler flaps. Leading-edge flaps. Wing area 27.2 m.² (292.8 sq. ft.).

FUSELAGE.— All-metal semi-monocoque structure. Hydraulically-operated perforated air-brake on each side of fuselage aft of wing. Braking parachute in aerodynamic fairing over jet nozzle. Rear fuselage detaches aft of wing to give access to engine.

TAIL UNIT.—Cantilever monoplane type, with tailplane mid-set on fin. Sweepback of 35° on fin and 20° on tailplane leading edges. Variable-incidence one-piece tailplane. All-metal construction. Moving surfaces, of thin sheet aluminium alloy stiffened by bonded-on foam plastic, operated through Jacottet-Leduc servo-controls. Tailplane span 4.50 m. (14 ft. 9 in.).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Dowty oleo-pneumatic shock-absorbers. All units fitted with twin low-pressure tyres. Hydraulic brakes. Wheel track 3.10 m. (10 ft. 2 in.). Wheelbase 5.50 m. (18 ft.).

POWER PLANT.—One Armstrong Siddeley Sapphire turbojet engine. Fuel in wing-tip tanks and collector tank in fuselage. Additional tanks can be carried in wings for long-range operations.

ACCOMMODATION.—Pilot in air-conditioned cockpit, on Martin-Baker ejection seat under transparent canopy. Electrically-heated windshield.

ARMAMENT.—Two Oerlikon Type 302 RK 30 mm. cannon in nose. Bombs or rockets can be stowed inside wings.

DIMENSIONS (approx.).—
Span 11 m. (36 ft. 1 in.).
Length 14 m. (45 ft. 11 in.).
Height 4.50 m. (14 ft. 9 in.).

WEIGHTS AND PERFORMANCE.—
No details available.

PILATUS

PILATUS FLUGZEUGWERKE A.G.

HEAD OFFICE AND WORKS: STANS, NEAR LUCERNE.
Managing Director: H. F. Alioth.
Chief Engineer: Dipl. Ing. H. Fierz.

Pilatus Flugzeugwerke A. G. was formed in December, 1939, with a capital of two million Swiss francs and it began work in September, 1941. A founder's syndicate was formed in 1938 under the leadership of M. E. Bührle, the Swiss industrialist and owner of the Oerlikon Company, of which the Pilatus Company is now a subsidiary.

The first product of the company was the SB-2 Pelican, a four/six-seat cabin monoplane which was developed by the Swiss Aerotechnical Association at the Swiss Institute of Technology at Zürich in collaboration with the Pilatus company.

Later productions were the P-2 advanced training monoplane, which was supplied in a small quantity to the Swiss Air Force, and the P-4 five-seat cabin monoplane.

The latest Pilatus product is the P-3 advanced training monoplane, the prototype of which made its first flight on September 3, 1953. A military version, is in production for the Swiss Air Force and is described hereafter.

THE PILATUS P-3.

The Model P-3, of which a series of 60 is being built for the Swiss Air Force, is suitable for *ab initio* and advanced training, including all aerobatics and inverted flight for short periods, night flying, instrument and blind flying, and weapon training.

In the Swiss Air Force, these aircraft will be used for "all-through" training



The Pilatus P-3 Two-seat Advanced Trainer (260 h.p. Lycoming engine).

prior to advanced training on de Havilland Vampire jet-trainers.

Optional equipment includes a removable hood over the rear seat, oxygen apparatus, one machine-gun with 180 rounds of ammunition in a pod below the port wing, racks for two practice bombs below the starboard wing, one training rocket launcher beneath each wing and a gun camera.

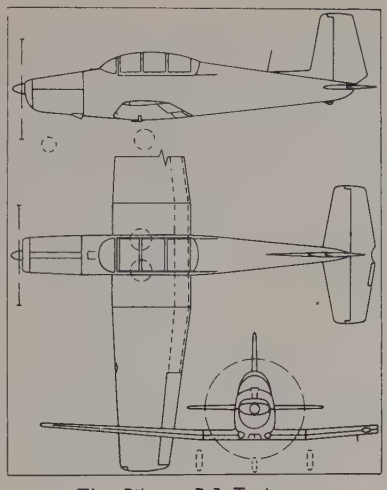
TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane. NACA Series 64A wing section with 12% t/c ratio. Aspect ratio 6.55. Chord 1.9 m. (6 ft. 2¾ in.) at root, 1.14 m. (3 ft. 8¾ in.) at tip. Dihedral 3° on upper surface of wing. Incidence +1° at root, −1° at tip. Sweepback 1° at 25% of chord. Single-spar aluminium-alloy structure. Ailerons and electrically-actuated slotted flaps of similar construction. Total area of ailerons 1.66 m.² (17.8 sq. ft.). Total area of flaps 2.03 m.² (21.8 sq. ft.). Gross wing area 16.5 m.² (177 sq. ft.).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: fin 0.72 m.² (7.7 sq. ft.), rudder 0.73 m². (7.8 sq. ft.), tailplane 2.0 m.² (21.5 sq. ft.), elevators 1.25 m.² (13.4 sq. ft.). Span of tail 3.25 m. (10 ft. 8 in.).

LANDING GEAR.—Retractable tricycle type. Electro-mechanical retraction, with provision for manual lowering in emergency. Pilatus oil/steel spring shock-absorbers. Goodyear wheels and disc brakes. Wheelbase 2.37 m. (7 ft. 6 in.). Track of main wheels 2.62 m. (8 ft. 6 in.).



The Pilatus P-3 Trainer.

POWER PLANT.—One 260 h.p. Lycoming GO-435-C2A six-cylinder horizontally-opposed air-cooled engine. Hartzell three-blade constant-speed metal airscrew. Two fuel tanks in leading-edge of centre-section with total capacity of 160 litres (35.2 Imp. gallons). Oil capacity 11.3 litres (2.4 Imp. gallons).

ACCOMMODATION.—Crew of two in tandem with dual controls. One-piece sliding canopy operated by crank and jettisonable in emergency. Adjustable seats. Full instrumentation for day and night flying. Combined ventilation, heating and defrosting system. R/T transmitter and receiver.

OPTIONAL EQUIPMENT.—Provision for one machine-gun, two launchers for 5 cm. Oerlikon training rockets, racks for two practice bombs, gun camera, oxygen equipment.

DIMENSIONS.—
Span 10.40 m. (34 ft. 1 in.).
Length 8.75 m. (28 ft. 8 in.).
Height 3.05 m. (10 ft.).

WEIGHTS.—
Weight equipped 1,110 kg. (2,447 lb.).
Weight loaded 1,415 kg. (3,120 lb.).
Max. permissible loaded weight, with optional equipment, 1,500 kg. (3,307 lb.).

PERFORMANCE (at 1,500 kg. = 3,307 lb. A.U.W.).—
Max. speed from S/L. to 2,000 m. (6,560 ft.) 310 km.h. (192.5 m.p.h.).
Max. diving speed 500 km.h. (310 m.p.h.).
Max. cruising speed 275 km.h. (170 m.p.h.).
Econ. cruising speed 252 km.h. (157 m.p.h.).
Min. speed 100 km.h. (62 m.p.h.).
Rate of climb at S/L. 420 m./min. (1,378 ft./min.).
Rate of climb at 2,000 m. (6,560 ft.) 222 m./min. (722 ft./min.).
Service ceiling 5,500 m. (18,040 ft.).
Absolute ceiling 6,100 m. (20,000 ft.).
Take-off distance to 15 m. (50 ft.) at S/L. on hard runway 342 m. (374 yds.).
Landing distance from 15 m. (50 ft.) at S/L. on hard runway 390 m. (427 yds.).
Max. still air range 750 km. (465 miles).

TURKEY

M.K.E.K.

MAKINA VE KIMYA ENDUSTRISI KURUMU.

HEAD OFFICE: M.K.E. GENEL MÜDÜRLÜK, ANKARA.

AIRCRAFT ENGINEERING DIVISION: M.K.E. GENEL MÜDÜRLÜK, ANKARA.

AIRCRAFT FACTORY: M.K.E. UCAK FB., ETIMESGUT, ANKARA.

General Manager, M.K.E.K.: Fuat Yücesoy, M.Sc. (Mech.E.).

Manager, Aircraft Factory: Yavuz Kansu, M.Sc.(Ae.E.).

The Aircraft Factory of the M.K.E.K. was originally founded by the Turkish Air League (Turk Hava Kurumu) in 1941.

In 1952 the factory was taken over by the M.K.E.K., an official establishment which includes the principal branches of the mechanical and chemical industries in Turkey. Aircraft manufacture in Turkey is now being undertaken solely by this State organisation.

THE M.K.E.K. MODEL 3.

This will be a tandem two-seat jet-powered basic trainer, all details of which are at present withheld.

THE M.K.E.K. MODEL 4 UGUR (LUCK).

The Model 4 military two-seat tandem primary trainer is in service in the Turkish Air Force. Examples have also been presented to the Royal Jordanian Air Force.

TYPE.—Two-seat Primary Trainer.

WINGS.—Low-wing cantilever monoplane. Clark YH wing section. Aspect ratio 5.7.



The M.K.E.K. Model 4 Ugur Primary Trainer (145 h.p. Gipsy Major engine).

Mean aerodynamic chord 1.674 m. (5 ft. 6 in.). Dihedral 7.5°. Incidence 2°. Two-spar wood structure with plywood coverings. Conventional all-wood split flaps and ailerons. Total area of flaps 1.1 m.² (11.8 sq. ft.). Total area of ailerons 1.36 m.² (14.6 sq. ft.). Gross wing area 15.9 m.² (171 sq. ft.).

FUSELAGE. — All - wood plywood - covered structure.

TAIL UNIT.—Cantilever monoplane type. Wood frames with plywood-covered fixed surfaces and fabric-covered rudder and elevators. Areas: fin 0.2 m.² (2.15 sq. ft.), rudder 0.9 m.² (9.6 sq. ft.), tailplane 1.7 m.² (18.3 sq. ft.), elevators 1.1 m.² (11.8 sq. ft.). Span of tail 2.7 m. (8 ft. 10 in.).

LANDING GEAR.—Fixed type. Dowty liquid-spring shock-absorbers. Goodyear wheels and hydraulic brakes. Track 2.25 m. (7 ft. 4½in.).

POWER PLANT.—One 145 h.p. Turkish-built D.H. Gipsy Major four-cylinder inverted air-cooled engine. Fairey-Reed fixed-pitch metal airscrew. Fuel tanks in wings. Total internal fuel capacity 20 Imp. gallons (90 litres).

ACCOMMODATION.—Tandem cockpits under continuous transparent canopy. Dual controls. Adjustable seats.

DIMENSIONS.—
Span 9.5 m. (31 ft. 2 in.).
Length 7.5 m. (24 ft. 7 in.).
Height 2.16 m. (7 ft.).

WEIGHTS.—
Weight loaded 923 kg. (2,030 lb.).

PERFORMANCE.—
Max. speed at S/L. 216 km.h. (135 m.p.h.).
Cruising speed 192 km.h. (120 m.p.h.).
Stalling speed 72 km.h. (45 m.p.h.).
Initial rate of climb 244 m./min. (800 ft./min.).
Service ceiling 4,575 m. (15,000 ft.).
Normal range 512 km. (320 miles).
Take-off distance to clear 15 m. (50 ft.) 335 m. (366 yds.).
Landing distance from 15 m. (50 ft.) 366 m. (400 yds.).

THE UNITED STATES OF AMERICA

THE DESIGNATION OF AMERICAN SERVICE AIRCRAFT.

The U.S. Air Force and U.S. Navy use separate and distinctive systems to designate their aircraft, while the U.S. Army has recently begun to use a system similar to that of the U.S.A.F. The three schemes currently in use are described below.

The U.S. Air Force.

Aircraft of the U.S.A.F. are identified by a system in which the function of the aircraft is shown by letters.

B	Bomber	K	Tanker	S	Search and Rescue
C	Cargo and Transport	L	Liaison	T	Trainer
F	Fighter	Q	Target and Drone	V	Convertiplane
H	Helicopter	R	Reconnaissance	X	Special Research

These symbols are used either singly or, where an aircraft fulfils more than one function, in combination (*i.e.* KC, Tanker Transport, RB, Reconnaissance-Bomber, etc.), the symbols being followed by a number to indicate the model, the numbers running consecutively throughout the class or function irrespective of manufacture. The letters A, for amphibian ; D, director for drones and missiles ; E, exempt on special test or attached to non-military agency ; G, carrier of operational missiles or parasites ; M, missile ; U, utility ; V, administrative transport ; and W, weather reconnaissance, are used in conjunction with other functional letters, but never alone.

Model changes are indicated by letters immediately following the basic model number (*i.e.* F-100A, F-100F, etc.). These qualifying letters usually indicate changes in power-plant, structure and/or equipment which affect interchangeability of parts and components, maintenance or tactical use.

The prefixes X, to indicate prototype ; Y, limited procurement for service trials ; and Z, obsolete ; are still used.

U.S. Naval Aviation.

U.S. Naval aircraft are designated by a system which incorporates letters to define the function and identify the manufacturer of the aircraft, and numbers to indicate the model and modifications of the model.

The functions of fixed-wing piloted aircraft are covered by the following letters :—

A	Attack	R	Transport	U	Utility
F	Fighter	S	Anti-submarine	V	Convertiplane
O	Observation	T	Trainer	W	Special Search
P	Patrol				

Helicopters have the Symbol H with additional qualifying functional letters, thus :—

HH	Search and Rescue	HR	Transport	HT	Training
HO	Observation	HS	Anti-submarine	HU	Utility

A series of suffix letters to follow the model number is also used to indicate special modifications or specially-equipped versions of otherwise standard types. These are as follows :—

A	Amphibian	J	Target Tug	R	Transport
B	Special Armament	K	Target Drone	S	Anti-submarine Warfare equipment
C	Carrier conversion of non-carrier type	L	Searchlight or winterised	T	Training
D	Drone Control	M	Missile launcher	U	Utility
E	Special Electronic Gear	N	Night-operating aircraft	W	Special Search
G	Search and Rescue	P	Photo-Reconnaissance	Z	Administrative
H	Ambulance	Q	Counter-measures Aircraft		

The individual aircraft designations are made up of the functional letter, a model number, the manufacturer's letter and following a hyphen, a modification or mark number. For example, AD-1 broken down to its component symbols indicates that the aircraft is an Attack type (A) built by Douglas (D) and that it is the first (-1) variation or mark of the basic type. Developments of this aircraft are the AD-2, AD-3, AD-4, etc. Typical specially equipped versions of this aircraft, indicated by suffix letters, are the AD-3Q (radar counter-measures version), AD-4N (night bomber version) and AD-5W (special search version). The next entirely new Attack design by Douglas was the A2D-1.

The list below details the letters which have been allotted to aircraft manufacturers :—

B	Beech Aircraft Corporation Boeing Airplane Company	M	Martin Company
		N	Gyrodyne Company of America, Inc.
C	de Havilland Aircraft of Canada, Ltd.	P	Vertol Aircraft Corporation
D	Douglas Aircraft Company, Inc.	Q	Fairchild Engine and Airplane Corporation
E	Cessna Aircraft Company, Inc. Hiller Helicopters, Inc.	R	Ryan Aeronautical Company Radioplane Division, Northrop Aircraft, Inc.
F	Grumman Aircraft Engineering Corporation	S	Sikorsky Aircraft (United Aircraft Corporation)
H	McDonnell Aircraft Corporation	T	Northrop Aircraft, Inc.
J	North American Aviation, Inc.	U	Chance Vought Aircraft, Inc.
K	Kaman Aircraft Corporation.	V	Lockheed Aircraft Corporation
L	Bell Helicopter Corporation	Y	Convair Division, General Dynamics Corporation.

U.S. Army Aviation.

The U.S. Army allots specific designations to its aircraft on the U.S.A.F. pattern. Those already announced are :—

AO	Observation (fixed-wing)	AC	Cargo
HO	Observation (rotary-wing)	AR	Reconnaissance

It has also selected its own (Indian tribal) names for most of the aircraft at present in, or about to go into, service ; the exceptions being those aircraft which already have well-known popular names. Army names so far announced are :—

Sioux	Bell H-13	*Mojave*	Sikorsky H-37	**Caribou*	DHC.4
Chickasaw	Sikorsky H-19	*Iroquois*	Bell H-40	*Mohawk*	Grumman AO-1
Shawnee	Vertol H-21	*Seneca*	Cessna XH-41	**Bird Dog*	Cessna L-19
Raven	Hiller H-23	*Pawnee*	Hiller Flying Platform	**Beaver*	DHC. L-20
Chocktaw	Sikorsky H-34	*Seminole*	Beech L-23	**Otter*	DHC. U-1

*Former names retained.

AERO

AERO DESIGN AND ENGINEERING CO.

HEAD OFFICE: P.O. Box 118, BETHANY, OKLAHOMA.

Chairman of the Board of Directors: George T. Pew.

President: Rufus T. Amis, Jr.

Vice-President, Director of Sales: R. J. White.

Vice-President, Operations: J. Laister.

Vice-President, Research and Development: T. R. Smith.

Vice-President, Director of Industrial Relations: H. S. Newman.

Controller: Gene Burke.

Secretary and Treasurer: Budd Parks.

This Company was formed in October, 1950, to manufacture the Aero Commander twin-engined five/seven-seat light transport monoplane. The Aero Commander 520 received its Approved Type Certificate on January 30, 1952, and the first production aircraft was delivered on February 5, 1952. 150 were built before the 520 model was succeeded in production by the 560 model in 1954.

Eighty Aero Commander 560's were produced before this type was superseded by the developed 560A model, of which 102 were built. Concurrently with this version, the Aero Commander 680 Super was put into production in the latter part of 1955 and is still being built, together with a further-improved version of the 560 model known as the 560E. This has a greater wing span than the 560A, which it superseded in production in the spring of 1957. There are now more than 550 Aero Commanders of all types in service all over the world, including the military versions tabulated below.

THE AERO COMMANDER 560E.

U.S.A.F. designation: L-26.

In addition to civilian sales of the various versions of the Aero Commander, the U.S.A.F. and U.S. Army have purchased a number of these aircraft, under the following designations:—

YL-26. Three Aero Commander 520's for service trials with U.S. Army.

YL-26A. One Aero Commander 560 for U.S.A.F.

L-26B. Thirteen standard 560A's for U.S.A.F. Used as V.I.P. transports. One for U.S. Army.

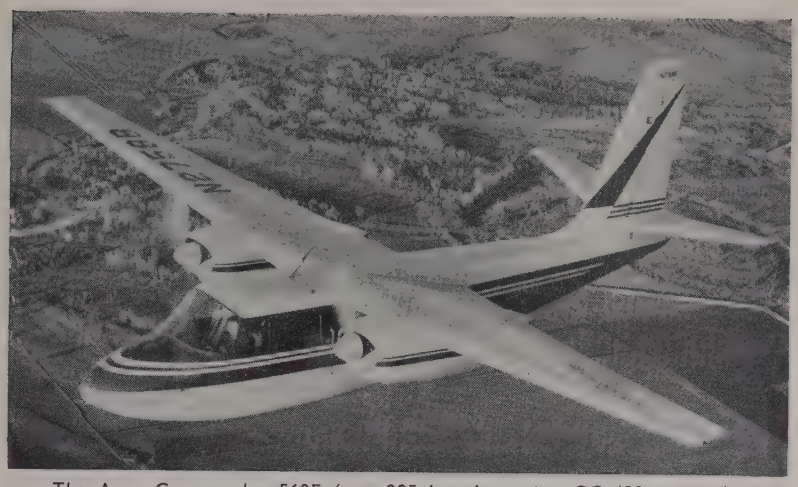
L-26C. Aero Commander 680 Super. Two for U.S.A.F. and four for U.S. Army.

RL-26D. New designation of L-26C with special radar.

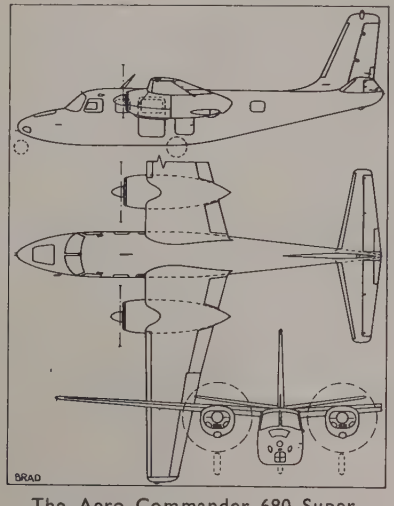
Two of the U.S.A.F.'s Aero Commanders are reserved for the use of the President and his staff.

On May 28, 1957, a new international Class C.1d distance record of 1,522 miles (2,449 km.) was set up by a 560E piloted by Miss J. Cobb, who flew non-stop from Guatemala City to Oklahoma City in 8 hours 5 minutes.

The following details apply to the current production Aero Commander 560E, of which the prototype flew on December 18, 1956 and the first production model on April 2, 1957.



The Aero Commander 560E (two 295 h.p. Lycoming GO-480 engines).



The Aero Commander 680 Super.

TYPE.—Twin-engined light transport Monoplane.

WINGS.—Cantilever high-wing monoplane. Wing section NACA 23012 modified. Aspect ratio 9.45. Chord (root) 8 ft. 4 in. (2.54 m.), (tip) 2 ft. 1½ in. (0.65 m.). Dihedral 4°. Incidence 3° at root, −3.5° at tip. All-metal two-spar structure. Hydraulically-operated slotted all-metal flaps between ailerons and fuselage. Total flap area 21.2 sq. ft. (1.97 m.²), total aileron area 20.5 sq. ft. (1.90 m.²). Gross wing area 255 sq. ft. (23.69 m.²).

FUSELAGE.—All-metal semi-monocoque structure with sheet metal covering.

TAIL UNIT.—Cantilever semi-monocoque all-metal structure with metal covering over all surfaces and 10° dihedral on tailplane. Trim-tabs in elevators and rudder. Areas: fin 22.8 sq. ft. (2.12 m.²), rudder 15.4 sq. ft. (1.43 m.²), tailplane 33.06 sq. ft. (3.07 m.²), elevators 20.5 sq. ft. (1.90 m.²). Span of tailplane 16 ft. 8 in. (5.08 m.).

LANDING GEAR.—Retractable tricycle type. Air-oil shock-absorbers. Hydraulic retraction. Goodyear wheels and Goodyear disc-type brakes. Track 12 ft. 11½ in. (3.95 m.). Wheelbase 13 ft. 8 in. (4.16 m.).

POWER PLANT.—Two 295 h.p. Lycoming GO-480-C1B6 six-cylinder horizontally-opposed air-cooled engines. Hartzell three-blade constant-speed full-feathering metal airscrews. Fuel capacity 223 U.S. gallons (843 litres) in bag-type tanks in wings. Oil capacity 8.5 U.S. gallons (31.8 litres).

ACCOMMODATION.—Enclosed cabin of 177 cub. ft. (5 m.³). Standard seating for two in front on individual adjustable seats with dual controls and full-width seat for three at rear of cabin. One or two additional seats may be added at extra cost. Main entry door under wing on port side. Door 20 in. (50.8 cm.) from ground. Cabin heater. All equipment can be removed to permit cabin to be used for freight-carrying, and floor may be reinforced. Optional arrangement provides for both passengers and freight. Baggage compartment aft of cabin with capacity of 34 cub. ft. (0.95 m.³).

DIMENSIONS.—
Span 49 ft. 0 in. (14.94 m.).
Length 35 ft. 5 in. (10.8 m.).
Height 14 ft. 6 in. (4.42 m.).

WEIGHTS AND LOADINGS.—
Weight empty 4,300 lb. (1,950 kg.).
Weight loaded 6,500 lb. (2,948 kg.).
Wing loading 25.5 lb./sq. ft. (124.5 kg./m².).
Power loading 11.0 lb./h.p. (5.0 kg./h.p.).

PERFORMANCE.—
Max. speed at S/L. 222 m.p.h. (357 km.h.).
Cruising speed (70% rated power) at 10,000 ft. (3,050 m.) 210 m.p.h. (338 km.h.).
Rate of climb at S/L. 1,450 ft./min. (442 m./min.).
Rate of climb at S/L. on one engine 300 ft./min. (90 m./min.).
Service ceiling 22,500 ft. (6,860 m.).
Service ceiling on one engine 8,000 ft. (2,440 m.).
Stalling speed at S/L. (flaps at 40°, landing gear down, power off) 66 m.p.h. (106 km.h.).
Take-off distance to clear 50 ft. (15.25 m.), no wind 1,452 ft. (442 m.).
Landing distance from 50 ft. (15.25 m.) 1,500 ft. (460 m.).
Range (at 55% S/L. rated power, 30 min. fuel reserve) at 10,000 ft. (3,050 m.) 1,625 miles (2,615 km.).



The Aero Commander L-26B Light Military Transport.

THE AERO COMMANDER 680 SUPER.

U.S. Army designation: L-26C.

Announced in September, 1955, this version of the Aero Commander has supercharged engines and is claimed to be the fastest aircraft in production expressly for business use.

An international class height record of 30,330 ft. (9,244.6 m.) was set up by Miss J. Cobb in a standard production 680 Super in August, 1957.

The general description of the Model 560E applies to the 680 Super except for the following:—

POWER PLANT.—Two Lycoming GSO-480-A1A-6 supercharged six-cylinder horizontally-opposed air-cooled engines, each with 340 h.p. available for take-off and 320 h.p. for continuous operation. Fuel capacity 233 U.S. gallons (883 litres).

DIMENSIONS.—
As for Model 560E except:
Span 44 ft. 0¾ in. (13.42 m.).

WEIGHTS AND LOADINGS.—
Weight empty 4,330 lb. (1,964 kg.).
Weight loaded 7,000 lb. (3,175 kg.).
Wing loading 28.9 lb./sq. ft. (141.1 kg./m.²).
Power loading 10.3 lb./h.p. (4.67 kg./h.p.).

PERFORMANCE.—
Max. speed at 10.000 ft. (3,050 m.) 260 m.p.h. (418 km.h.).
Cruising speed (70% rated power) at 10,000 ft. (3,050 m.) 230 m.p.h. (370 km.h.).
Cruising speed (65% rated power) at 15,000 ft. (4,570 m.) 230 m.p.h. (370 km.h.).
Rate of climb at S/L. 1,600 ft./min. (488 m./min.).
Rate of climb at S/L. on one engine 310 ft./min. (95 m./min.).
Service ceiling 24,200 ft. (7,375 m.).
Service ceiling on one engine 15,000 ft. (4,570 m.).
Stalling speed at S/L. (flaps at 40°, landing gear down, power off) 71 m.p.h. (114 km.h.).
Stalling speed at S/L. (flaps and gear retracted, power off) 79 m.p.h. (127 km.h.).
Range (at 55% S/L. rated power, 30 min. fuel reserve) at 10.000 ft. (3,050 m.) 1,480 miles (2,382 km.).
Range (at most economical cruising speed) 1,600 miles (2,575 km.).
Take-off distance to clear 50 ft. (15.25 m.), no wind 1,575 ft. (480 m.).
Landing distance from 50 ft. (15.25 m.), no wind 1,630 ft. (497 m.).



The Aero Commander 680 Super (two 340 h.p. Lycoming GSO-480 engines).

AEROCAR

AEROCAR, INC.

HEAD OFFICE AND WORKS: LONGVIEW AIRPORT, WASH.

President and General Manager: Moulton B. Taylor.

Aerocar, Inc. has been developing since February, 1948, a flying automobile designed by Mr. M. B. Taylor. The prototype Aerocar, with a Lycoming O-320 engine, was completed in October, 1949. Well over 100,000 miles of air and ground travel experience have been gained with this prototype and a pre-production Aerocar, which was used for tests which led to C.A.A. Airworthiness Certification of the Aerocar in December, 1956.

Three additional Aerocars have been completed for demonstration tours of the United States. Two of these are fitted with more powerful Lycoming O-340 and Lycoming O-360 engines respectively and are being tested for C.A.A. certification.

THE AEROCAR MODEL ONE.

The Aerocar is a convertible aeroplane and road vehicle which incorporates a number of features not previously introduced in craft of this type.

The four-wheel automobile section accommodates two seated side-by-side and encloses in the rear portion a 150 h.p. Lycoming engine which provides front-wheel automobile drive and drives a pusher propeller aft of the tail-unit.

The road wheels are driven through a special "fluid drive" system, and the propeller shaft is also driven through a unique new "dry fluid drive" which uses steel shot as the energy transmitting medium. The latter is said to result in smooth and vibration-free operation of the long propeller shaft.

A three-control flight system is combined with the automobile controls, the same wheel being used for both. Conventional clutch and foot brake pedals are provided, together with three forward speeds and reverse in the wheel drive.

The flight section consists of a pair of rigidly-braced wings and a tail section which carries the tail and encloses the drive for the pusher propeller. When the flight section is detached from the body, the wings, which have trailer wheels inset in the leading-edges of the wing roots, may be folded to each side of the tail section and the flight section towed tail first behind the automobile section. The change-over from road transportation to aircraft can be accomplished without special equipment by one person in 5 minutes and all component locks are fool-proof.

TYPE.—Two/three-seat Flying Automobile.

WINGS.—High-wing rigidly-braced monoplane. Wing section NACA 43012. Aspect ratio 6. Chord 5 ft. 8 in. (1.73 m.). Dihedral 2°. Incidence 6°. 24ST aluminium-alloy structure. Plain balanced all-metal ailerons. No flaps. Area of ailerons (two) 19 sq. ft. (1.77 m.²). Gross wing area 190 sq. ft. (17.6 m.²).

FUSELAGE.—In two parts, the automobile body section and a detachable rear section carrying tail and propeller drive. 24ST aluminium-alloy construction, the auto body being covered with Fibreglass. The tail section is a monocoque.

TAIL UNIT.—Dihedral (25°) tailplane with fin and rudder beneath. 24ST aluminium-alloy construction. Areas: fin 3 sq. ft. (0.28 m.²), rudder 3 sq. ft. (0.28 m.²), tailplane 17 sq. ft. (1.58 m.²), elevators 9 sq. ft. (0.84 m.²). Tailplane span 8 ft. (2.44 m.).

LANDING GEAR.—Dual-purpose non-retractable quadricycle type. Front wheels steerable with ailerons. Independent suspension. Gabriel Automotive hydraulic shock-absorbers. Magnesium wheels with 4.50 × 12 tyres. Goodrich expander tube brakes on rear wheels. Fluid-drive to front wheels for road traction. Wheel track 5 ft. 2 in. (1.57 m.). Wheel base 6 ft. 8 in. (2.03 m.).

POWER PLANT.—One 143 h.p. (de-rated due to automotive modifications) Lycoming O-320 engine, driving through a "dry fluid drive," a Hartzell ground-adjustable pusher propeller with fibre blades. Diameter 6 ft. 4 in. (1.93 m.). Fuel tank in car with capacity of 23.5 U.S. gallons (88.9 litres). One 10 U.S. gallon (37.7 litres) auxiliary tank can be carried in each wing, giving total capacity of 43.5 U.S. gallons (164.3 litres). Oil capacity 2 U.S. gallons (7.5 litres).

ACCOMMODATION.—Pilot and passenger in car-type cabin, with dual controls. Cabin heating and ventilation. Baggage space 14 cub. ft. (0.40 m.³).

EQUIPMENT.—Includes windshield wipers, horn, battery, starter, generator, and all air and road lights and instruments required by U.S. vehicle codes.

DIMENSIONS (Aircraft).—
Span 34 ft. (10.37 m.).
Length 21 ft. 6 in. (6.56 m.).
Height 7 ft. 6 in. (2.29 m.).

DIMENSIONS (Automobile).—
Length 10 ft. 4 in. (3.15 m.).
Trailer length 15 ft. (4.57 m.).
Overall car/trailer length 26 ft. (7.92 m.).
Height 5 ft. 4 in. (1.62 m.).
Auto wheel track 5 ft. 2 in. (1.57 m.).
Auto wheel base 6 ft. 8 in. (2.03 m.).
Max. width of trailer 8 ft. (2.44 m.).

WEIGHTS AND LOADINGS.—
Weight empty (auto) 1,012 lb. (460 kg.).
Weight empty (aircraft) 1,400 lb. (635 kg.).
Pilot and passenger 340 lb. (154 kg.).
Fuel and oil 144 lb. (65 kg.).
Baggage 60 lb. (27 kg.).
Trailer (wing and tail) 388 lb. (176 kg.).
Flying weight loaded 2,050 lb. (930 kg.).
Wing loading 10.3 lb./sq. ft. (50.3 kg./m.²).
Power loading 13.4 lb./h.p. (6.08 kg./h.p.).

PERFORMANCE (Aircraft).—
Max. permissible speed 139 m.p.h. (224 km.h.).
Max. level speed at S/L. 110 m.p.h. (176 km.h.).
Cruising speed (75% power) 100 m.p.h. (160 km.h.).
Landing speed 50-55 m.p.h. (80-89 km.h.).
Initial rate of climb 550 ft./min. (168 m./min.).
Service ceiling 12.000 ft. (3.660 m.).
Cruising range 300 miles (480 km.).
Take-off run 650 ft. (200 m.).
Landing run 300 ft. (91.5 m.).
Fuel consumption 8 U.S. gallons/hr. (30.3 litres/hr.).

PERFORMANCE (Automobile).—
Max. road h.p. 40.
Max. road speed 67 m.p.h. (108 km.h.) at 2,700 r.p.m.
Practical road cruising speed 55 m.p.h. (88.5 km.h.).
Practical speed with wings in tow 50 m.p.h. (80 km.h.).
Road acceleration to 62 m.p.h. (100 km.h.) in ½ min.
Road range 300 miles (480 km.).
Road turning radius 15 ft. (4.57 m.).
Road fuel consumption 15 miles/U.S. gallon (5.3 km./litre).



The Aerocar Model One (143 h.p. (de-rated) Lycoming O-320 engine).

AERONCA

THE AERONCA MANUFACTURING CORPORATION.

HEAD OFFICE AND WORKS: 1712, GERMANTOWN ROAD, MIDDLETOWN, OHIO.

President: John A. Lawler.

Vice-President, Operations: S. H. Badgett.

Vice-President, Technical Services: W. W. Ford.

Vice-President, Projects: R. F. Hermes.

Secretary and Treasurer: S. J. Kudrer.

Vice-President and General Manager, Industrial Research Laboratories Division: G. Philip Stout, Baltimore 28, Md.

This Company was incorporated as the Aeronautical Corporation of America in November, 1928, and was the first American company to build and market a truly light aeroplane.

Between 1946 and 1950, when it abandoned light aeroplane manufacture and adopted its present company title, Aeronca built over 10,000 Model 7 Champions, and more than 600 L-16A and L-16B military liaison and training versions of the same basic aircraft were supplied to the Army Ground Forces.

In June, 1954, the manufacturing rights of the Model 7 Champion were sold to Flyers Service, Inc. of St. Paul, Minn., which company has formed the Champion Aircraft Corporation to continue the manufacture of this popular model.

The Company's principal current production is the manufacture of airframe assemblies, components and parts for major aircraft manufacturers. It is also producing jet engine assemblies and parts, brazed stainless steel honeycomb panels and structures and is developing metal bonding production.

The Industrial Research Laboratories Division is conducting research and development in electronic projects, radar trainers and in non-ferrous metals. A missile development programme has also been initiated.

BACON

ERLE L. BACON CORPORATION.

HEAD OFFICE AND WORKS: MUNICIPAL AIRPORT, SANTA MONICA, CALIFORNIA.

President: Erle Bacon.

This company has built an extensively-modernised version of the North American T-6 (Navy SNJ) training aircraft, which it has named the Super T-6, primarily for sale to foreign air forces. The prototype began its taxi tests at Santa Monica Airport on December 31, 1956, and flew for the first time in April, 1957.

THE BACON SUPER T-6.

The Super T-6 is an extensively-modified conversion of the North American T-6 tandem two-seat advanced training aircraft, many thousands of which are in operation throughout the world.

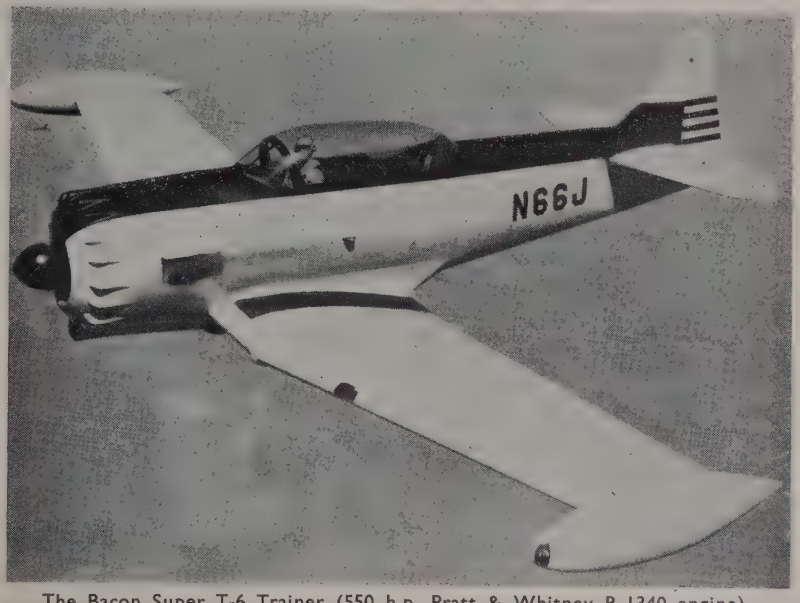
Its principal features include an entirely new tricycle landing gear, a modernised power package with jet stacks and augmentor cooling, and a one-piece streamlined cockpit canopy. The cockpit and instrument panel have been modernised, and the airframe has been cleaned up generally to reduce weight and drag, including a 4 ft. (1.22 m.) reduction in wing span. New lightweight Goodyear wheels with spot-type single-disc brakes and Bendix shock-absorbers are fitted.

Although the original centre-section fuel tanks have had to be deleted to make room for the re-located main landing gear when retracted, the total fuel capacity has been increased slightly by substituting two 50 U.S. gallon (189 litre) wing-tip tanks. Because of this, and the generally-cleaner design, cruising range is increased by approximately 20%. Cruising speed is increased by 45 m.p.h. (72 km.h.).

Optional equipment includes .30 in. machine-gun mountings, bomb racks and rocket launchers.

DIMENSIONS.—
Span 38 ft. 6 in. (11.74 m.).
Length 29 ft. 6 in. (8.99 m.).
Height 11 ft. 8½ in. (3.55 m.).
Wheel track 8 ft. 6 in. (2.59 m.).

PERFORMANCE.—
Max. speed approx. 225 m.p.h. (362 km.h.).
Cruising speed (64% power) 215 m.p.h. (346 km.h.).
Rate of climb at S/L over 1,750 ft./min. (533 m./min.).



The Bacon Super T-6 Trainer (550 h.p. Pratt & Whitney R-1340 engine).

BAUMANN

BAUMANN AIRCRAFT CORPORATION.

HEAD OFFICE: P.O. BOX 468, NORTH HOLLYWOOD, CALIFORNIA.

President: P. H. Bruns.

Baumann Aircraft Corporation was formed in 1945 primarily to develop and produce twin-engined all-metal executive transport aircraft. Its first product was the Model B-250 Brigadier, which first flew in June, 1947 and was sold two years later, without the sale of any design rights, to the Piper Aircraft Corporation.

The proceeds of this sale and additional funds, including the profits from subcontract work, were applied to the engineering and completion of most of the production tooling and part of the construction and certification programme of the first production Model B-290 Brigadier, with more powerful engines than the prototype. This aircraft was described in earlier editions of "All the World's Aircraft."

The B-290 is being modified into the De Luxe Brigadier Model B-360 with two 180 h.p. Lycoming engines, and this improved version was scheduled to go into production in Baumann's new factory in Arizona before the end of 1957.

In addition, the company is building the prototype of the Model B-480 Super Brigadier, with two 240 h.p. Continental engines, and is developing two further aircraft, the 10-seat Baumann Imperial and a jet-powered version of the Super Brigadier.

THE BAUMANN B-360 DE LUXE BRIGADIER.

TYPE.—Twin-engined five-seat pusher monoplane.

WINGS.—Cantilever shoulder-wing monoplane. All-metal construction. All-metal ailerons. Hydraulically-operated all-metal slotted trailing-edge flaps between nacelles and fuselage. Approximate wing area 209 sq. ft. (19.42 m.²).

FUSELAGE. — All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Controllable trim-tabs in rudder and elevators. Tailplane span 13 ft. 2 in. (4.01 m.).

LANDING GEAR.—Retractable tricycle type. Oleo shock-absorbers. Main wheels retract outward into wings. Hydraulic retraction. Goodyear tyres. Hydraulic brakes. Steerable nose-wheel. Track 12 ft. (3.66 m.).

POWER PLANT.—Two 180 h.p. Lycoming horizontally-opposed air-cooled engines mounted as pusher units and driving constant-speed fully-feathering two-blade airscrews. Fuel capacity 76 U.S. gallons (288 litres).



The Baumann B-360 De Luxe Brigadier (two 180 h.p. Lycoming engines).

ACCOMMODATION.—Enclosed cabin seating pilot (on port side) and one passenger side-by-side, and with full-width seat for three passengers behind. Access door on port side. Width inside cabin 4 ft. 2 in. (1.27 m.). Height inside cabin 4 ft. 2 in. (1.27 m.). Baggage compartment of 70 cub. ft. (1.98 m.³) capacity aft of rear seat.

DIMENSIONS.—
Span 41 ft. 0 in. (12.49 m.).
Length 28 ft. 5 in. (8.66 m.).
Height 10 ft. 4 in. (3.15 m.).

WEIGHTS.—
Weight empty 2,700 lb. (1,225 kg.).
Weight loaded 4,050 lb. (1,837 kg.).

PERFORMANCE estimated).—
Max. speed 220 m.p.h. (354 km.h.).
Cruising speed (75% power) 205 m.p.h. (330 km.h.).
Landing speed 63 m.p.h. (101 km.h.).
Rate of climb at S/L. 1,500 ft./min. (457 m./min.).
Rate of climb, one engine out, 500 ft./min. (150 m./min.).
Service ceiling 22,000 ft. (6,700 m.).
Service ceiling, one engine out, 10,000 ft. (3,050 m.).
Range 900 miles (1,450 km.).

THE BAUMANN B-480 SUPER BRIGADIER.

A prototype of the B-480 Super Brigadier is under construction. It will be generally similar to the Model B-360 De Luxe Brigadier, but will have two 240 h.p. Continental O-470-B engines. The fuselage nose forward of the instrument panel and the tail cone fairing will each be 10 in. (0.25 m.) longer than on the Model B-360, and the wing span will be reduced by 5 ft. 4 in. (1.63 m.) by cropping the outer panels.

BEECHCRAFT

BEECH AIRCRAFT CORPORATION.

HEAD OFFICE AND MAIN WORKS: WICHITA, KANSAS.

BRANCH FACTORIES: HERINGTON AND LIBERAL, KANSAS.

BRANCH ENGINEERING OFFICES: BOULDER, COLORADO.

President: Mrs. O. A. (Walter H.) Beech.

Vice-President and General Manager: John P. Gaty.

Vice-President and Co-ordinator Frank E. Hedrick.

Vice-President—Manufacturing: C. C. Pearson.

Vice-President—Contract Administration: James N. Lew.

Vice-President — Commercial Sales: Leddy Greever.

Vice-President—Export Sales: M. G. Neuburger.

Vice-President—Military Sales: Lynn D. Richardson.

Secretary and Treasurer: John A. Elliott.

Assistant Treasurer: Lee O. Higdon.

Assistant Secretary: L. Winters.

Founded in 1932 by the late Walter H. Beech, pioneer designer and builder of light aeroplanes in the United States, the Beech Aircraft Corporation is currently engaged in the production of civil and military aircraft, aircraft components, guided missiles, ground power-source generators and aircraft fuel tanks.

Civil aircraft in current production include the four-seat Model H-35 Bonanza, the four-seat Model 95 Travel Air, the six-seat Model D50 and Model E50 Twin-Bonanza, and the eight-seat Model E18S Super 18. Military aircraft in production include the L-23D and L-23E, six-seat versions of the Twin-Bonanza produced for the U.S. Army, the T-34A Mentor trainer for the U.S.A.F. and the T-34B Mentor trainer for the U.S. Navy. The company has also produced the prototype Model 73 Jet Mentor, a two-seat tandem jet monoplane which is undergoing extensive evaluation tests by the U.S. Armed Services and the R.C.A.F. The rights to build the Jet Mentor in Canada have been acquired by the Canadian Car Company.

Beechcraft are also developing a small executive aircraft designated Model 112, with two Lycoming T53 turboprop engines.



The Beechcraft Model 95 Travel Air (two 180 h.p. Lycoming O-360 engines).

Wholly-owned subsidiaries of the parent company include Beech Research and Development, Inc., which will handle military projects of a classified nature, and Beech Acceptance Corporation (Inc.) which is engaged in leasing aircraft to private business firms.

Beech Aircraft's three plants in Wichita, a special engineering facility in Boulder, Colorado, and plants in Herington and Liberal, Kansas, are also engaged in extensive major sub-contract and research work in the development of advanced jet and guided missile products. Current sub-contracts include work on the Lockheed T-33A and T-2V; the Republic F-84F, the McDonnell F-101A, the Convair F-102 and F-106.

THE BEECHCRAFT MODEL 95 TRAVEL AIR.

Bearing a name that was carried by all the early aircraft designed by the late Walter H. Beech, the Travel Air is a four-seat executive aircraft, of which the prototype made its first flight on August 6, 1956. It received its CAA Type Certificate on June 18, 1957.

It was originally named Badger, but this was changed to avoid confusion with the Russian twin-jet bomber that has been code-named "Badger" by N.A.T.O. air forces.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 23000 series wing section. Aspect ratio 7.38. Mean chord 5 ft. 3 in. (1.61 m.). Dihedral 6°. Incidence 4°. Each wing is a two-cell semi-monocoque box beam of aluminium alloy construction. Plain flap-type ailerons of magnesium construction. Single slotted aluminium alloy flaps. Total area of ailerons 11.5 sq. ft. (1.07 m.²). Total area of flaps 21.3 sq. ft. (1.98 m.²). Gross wing area 193.8 sq. ft. (18.00 m.²).

FUSELAGE.— Semi-monocoque aluminium alloy structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: fin 16.67 sq. ft. (1.55 m.²), rudder 6.63 sq. ft. (0.62 m.²), elevators 15.0 sq. ft. (1.39 m.²), tailplane 27.4 sq. ft. (2.54 m.²).

LANDING GEAR.—Retractable tricycle type. Beech air-oil shock absorbers. Electric retraction. Goodyear single-disc hydraulic brakes. Wheel track 9 ft. 7½ in. (2.93 m.) Wheelbase 7 ft. 5½ in. (2.26 m.).

POWER PLANT.—Two Lycoming O-360-A1A four-cylinder horizontally-opposed air-cooled engines, with 180 h.p. available at 2,700 r.p.m. for take-off. Hartzell Type 8447-6 airscrews. Fuel in four wing tanks with total capacity of 114 U.S. gallons (430 litres). Oil capacity 3 U.S. gallons (11.36 litres).

ACCOMMODATION.—Four-seat enclosed cabin. Two seats side-by-side in front, with orthodox throw-over dual controls, and full-width seat behind. Cabin dimensions 6 ft. 11 in. long × 3 ft. 6 in. wide × 4 ft. 2 in. high (2.11 × 1.07 × 1.27 m.). Access door 3 ft. × 3 ft. 1 in. (0.91 × 0.916 m.) on starboard side. Acrylic moulded windscreen and windows. Middle windows open for ground ventilation, and have release pins to permit their use as emergency exits. Cabin structure reinforced for protection in turn-over.

DIMENSIONS.—
Span 37 ft. 10 in. (11.53 m.).
Length 25 ft. 3½ in. (7.71 m.).
Height 9 ft. 6 in. (2.90 m.).

WEIGHT.—
Weight loaded 4,000 lb. (1,815 kg.).

PERFORMANCE.—
Max. speed at S/L. 208 m.p.h. (335 km.h.).
Max. cruising speed at 7,500 ft. (2,290 m.) 200 m.p.h. (322 km.h.).
Landing speed (flaps and wheels down) 66 m.p.h. (106 km.h.).
Rate of climb at S/L. 1,330 ft./min. (405 m./min.).
Service ceiling 19,700 ft. (6,000 m.).
Take-off run, zero wind 850 ft. (260 m.).
Take-off distance to 50 ft. (15.25 m.), zero wind 1,050 ft. (320 m.).
Max. still air range 1,370 miles (2,205 km.).



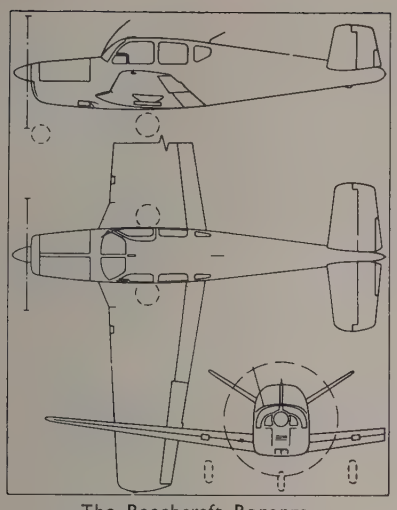
The Beechcraft Model H35 Bonanza (240 h.p. Continental O-470G engine).

THE BEECHCRAFT MODEL H35 BONANZA.

More than 4,500 Bonanzas have been built for private, executive and feeder-line operation. One of them holds the international Class C-1-c distance record of 4,957.24 miles (7,977.92 km.).

TYPE.—Four-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Beech modified NACA 23000 series aerofoil



The Beechcraft Bonanza.

section. All-metal structure. Aspect ratio 6.05. Chord 65.33 in. (1.7 m.). Dihedral 6°. Incidence 3°. Each wing panel is a two-cell semi-monocoque box beam of aluminium-alloy construction. Ailerons are made principally of magnesium alloy sheet. NACA single slotted flaps of aluminium alloy. Aileron area 11.5 sq. ft. (1.07 m.²). Flap area 23.3 sq. ft. (2.16 m.²). NACA slotted flaps between ailerons and fuselage. Wing area 177.6 sq. ft. (16.49 m.²).

Fuselage. — Semi-monocoque aluminium alloy structure.

Tail Unit.—"Butterfly" type consisting of tailplane and elevators set at acute dihedral angle. Elevators act also as rudders. Semi-monocoque construction with magnesium alloy skin covering on the control surfaces. Fin and tailplane area 23.8 sq. ft. (2.2 m.²). Rudder and elevator area 12.0 sq. ft. (1.11 m.²). Tailplane span 10 ft. 1⅝ in. (3.08 m.).

Landing Gear.—Retractable tricycle type. Beech air-oil shock struts. Electric retraction. Single-disc hydraulic brakes. Wheelbase 7 ft. 5¼ in. (2.28 m.). Track 9 ft. 7½ in. (2.93 m.).

Power Plant.—One Continental O-470G engine, rated at 240 h.p. at 2,600 r.p.m. for take-off. Beech 278 two-blade electrically-controlled variable-pitch airscrew, 7 ft. (2.13 m.) diameter, with Beech pitch control motor and Beech spinner. Hydraulic constant-speed airscrew governor. Two standard wing tanks, 39 U.S. gallons (148 litres) useable. Two auxiliary wing tanks, 18 gallons (68 litres) useable. Oil capacity 3 U.S. gallons (11.4 litres).

Accommodation.—Four-seat enclosed cabin. Two seats side-by-side in front, with orthodox throw-over dual controls, and full-width seat behind. Cabin dimensions 6 ft. 11 in. long × 3 ft. 6 in. wide × 4 ft. 2 in. high (2.11 × 1.07 × 1.27 m.). Access door 3 ft. × 3 ft. 1 in. (0.91 × 0.916 m.) on starboard side. Acrylic moulded windscreen and windows. Middle windows open for ground ventilation, and have release pins to permit their use as emergency exits. Cabin structure reinforced for protection in turn-over. Baggage compartment with capacity of 16.5 cub. ft. (0.47 m.³) and allowance of 270 lb. (122.5 kg.) aft of seats. Baggage access door 2 ft. × 1 ft. 10 in. (0.61 × 0.56 m.) on starboard side of fuselage.

Dimensions.—
Span 32 ft. 10 in. (10 m.).
Length 25 ft. 2 in. (7.67 m.).
Height 6 ft. 6½ in. (2 m.).

Weights and Loadings.—
Weight empty (fully equipped) 1,833 lb. (831 kg.).
Useful load 1,067 lb. (484 kg.).
Payload with max. fuel 810 lb. (367 kg.).
Weight loaded 2,900 lb. (1,315 kg.).
Wing loading (fully loaded) 16.3 lb./sq. ft. (79.6 kg./m.²).
Power loading (fully loaded) 12.1 lb./h.p. (5.49 kg./h.p.).

Performance.—
Max. speed 206 m.p.h. (331 km.h.) at sea level.
Max. cruising speed (75% power) 196 m.p.h. (315 km.h.). at 5,000 ft. (1,525 m.).
Econ. cruising speed (65% power) 190 m.p.h. (306 km.h.) at 8,000 ft. (2,440 m.).
Stalling speed, with flaps 57 m.p.h. (91.7 km.h.).
Rate of climb at sea level 1,250 ft./min. (380 m./min.).
Service ceiling 19,800 ft. (6,035 m.).
Max. range at 160 m.p.h. (257 km.h.) at 10,000 ft. (3,050 m.) 800 miles (1,287 km.) on 39 gallons (147.8 litres), 1,170 miles (1,883 km.) on 57 gallons (216 litres).
Take-off run in 10 m.p.h. (16 km.h.) wind at sea level (20° flaps) 670 ft. (205 m.).
Landing run in 10 m.p.h. (16 km.h.) wind at sea level (30° flaps) 400 ft. (122 m.).
Fuel economy at max. range 20.5 miles per U.S. gallon (8.7 km. per litre).

THE BEECHCRAFT MODEL 45 MENTOR.

U.S.A.F. designation : T-34A.
U.S. Navy designation: T-34B.

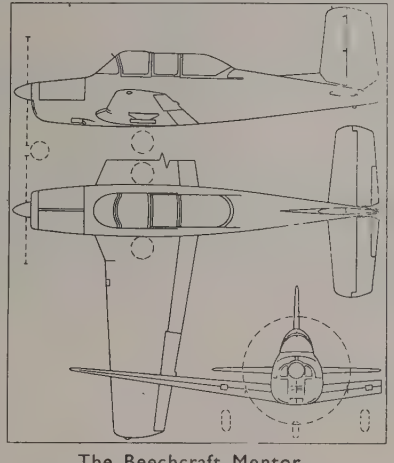
The Beechcraft Mentor is basically a military trainer adaptation of the Bonanza. It is standard equipment in the U.S. Air Force, U.S. Navy and the air forces of seven other nations, and is being manufactured under licence by Fuji Heavy Industries of Tokyo, Japan.

Two versions have been built, as follows :—

T-34A. For U.S.A.F. More than 300 built. Prototype flew on December 2, 1948.

T-34B. For U.S. Navy, with additional equipment. In production, with deliveries scheduled to continue until October, 1957. First T-34B delivered to U.S. Navy June, 1955.

Latest order for the T-34, from Argentina, will extend production into 1959. It involved the supply of 15 complete aircraft, followed by the dis-assembled components for approximately 75 more, which will be assembled in the Argentine government factory at Cordoba. All of these aircraft will carry the optional armament for weapons training.



The Beechcraft Mentor.

Type.—Two-seat Primary Trainer.

Wings.—Low-wing cantilever monoplane. Same type structure as for the Bonanza, but with incidence of 4°. Wing area 177.6 sq. ft. (16.49 m.²).

Fuselage.—Metal structure with flush-riveted metal skin.

Tail Unit.—Conventional cantilever monoplane type. All-metal structure of magnesium. Adjustable trim-tabs in elevators and rudder. Areas: fin 10.39 sq. ft. (.97 m.²), rudder 6.54 sq. ft. (.61 m.²), elevators 15 sq. ft. (1.39 m.²), tailplane 37.25 sq. ft. (3.46 m.²). Tailplane span 12 ft. 2⅛ in. (3.71 m.).

Landing Gear.—Retractable tricycle type. Same as for Bonanza. Electric retraction with emergency hand control. Beech air-oil struts on all wheels. Split-type wheels with single disc hydraulic brakes. Wheel track 9 ft. 7½ in. (2.94 m.). Wheelbase 7 ft. 5¼ in. (2.28 m.).

Power Plant.—One 225 h.p. Continental O-470-13 six-cylinder horizontally-opposed air-cooled engine. Beech Model 278-101 all-metal constant-speed airscrew 7 ft. 4 in. (2.23 m.) in diameter. Two wing fuel tanks. Capacity 50 U.S. gallons (225 litres). Oil capacity 2½ U.S. gallons (9.45 litres). Entire power-plant assembly including engine, airscrew, accessories and oil system, may be changed as a unit.

Accommodation.—Tandem cockpits under continuous transparent canopy with sections over each seat which may be independently opened or latched in intermediate positions. Conventional three-control system duplicated in each cockpit. Adjustable seats in both cockpits. Heating and ventilation. Windshield de-froster. Radio receiver, with range reception and transmission. Baggage compartment aft of rear cockpit.

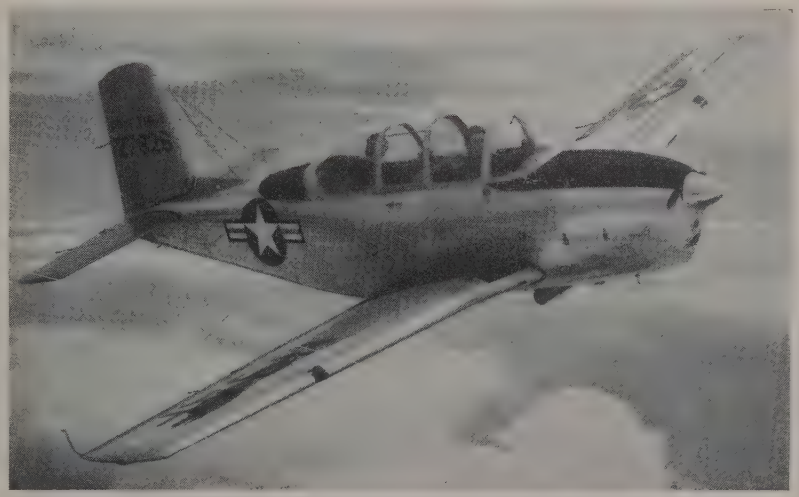
Armament (optional).—One machine-gun or camera gun in each wing. Bomb racks or rocket rails under wings.

Dimensions.—
Span 32 ft. 10 in. (10 m.).
Length 25 ft. 11 in. (7.9 m.).
Height (over tail) 9 ft. 7 in. (2.9 m.).

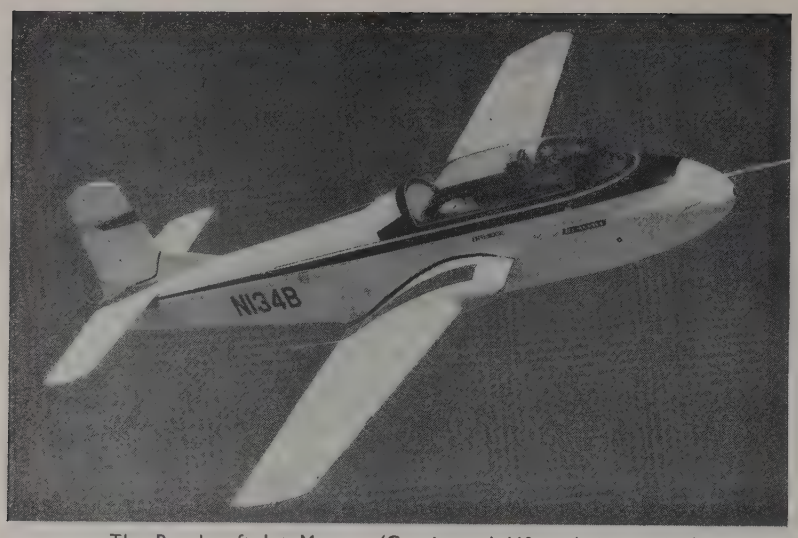
Weights and Loadings (T-34A).—
Weight empty 2,170 lb. (985 kg.).
Weight loaded 2,900 lb. (1,317 kg.).
Wing loading 16.3 lb./sq. ft. (79.54 kg./m.²).
Power loading 12.9 lb./h.p. (5.85 kg./h.p.).

Weights and Loadings (T-34B).—
Weight empty 2,246 lb. (1,019 kg.).
Weight loaded 2,975 lb. (1,350 kg.).
Wing loading 16.75 lb./sq. ft. (81.78 kg./m.²).
Power loading 13.2 lb./h.p. (5.99 kg./h.p.).

Performance (T-34A).—
Max. speed at S/L. 189 m.p.h. (304 km.h.).
Max. cruising speed 173 m.p.h. (277 km.h.). at 10,000 ft. (3,050 m.).
Stalling speed (flaps down) 54 m.p.h (87 km.h.).
Rate of climb at S/L. 1,230 ft./min. (375 m./min.).
Service ceiling 20,000 ft. (6,100 m.).
Max. cruising range 737 miles (1,186 km.).
Take-off to 50 ft. (15.25 m.) no wind (10° flaps) 1,200 ft. (366 m.).
Landing run from 50 ft. (15.25 m.) no wind (full flaps) 960 ft. (293 m.).



The Beechcraft T-34A Mentor (225 h.p. Continental O-470 engine).



The Beechcraft Jet Mentor (Continental J69 turbojet engine).

PERFORMANCE (T-34B).—
Max. speed 188 m.p.h. (302 km.h.).
Cruising speed 170 m.p.h. (274 km.h.).
Stalling speed (flaps down) 54 m.p.h. (87 km.h.).
Rate of climb at S/L. 1,160 ft./min. (354 m./min.).
Service ceiling 19,500 ft. (5,945 m.).
Range with max. payload 728 miles (1,171 km.).

THE BEECHCRAFT MODEL 73 JET MENTOR.

The Jet Mentor is a low-cost, economical, high-performance jet trainer, based on the T-34 Mentor and using many of the same components. Built as a private venture, to meet military specifications, it is America's first light single-engined jet aircraft. The prototype made its first flight on December 18, 1955.

TYPE.—Light two-seat Jet Trainer.

WINGS.—Low-wing cantilever monoplane, basically the same as for the T-34 Mentor. Aspect ratio 6.05. Chord 65.33 in. (1.7 m.). Dihedral 7°. Incidence 4°. Simple flap-type ailerons. Single slotted flaps. Aileron area 11.5 sq. ft. (1.07 m.²). Flap area 21.3 sq. ft. (1.98 m.²). Wing area 177.6 sq. ft. (16.49 m.²).

FUSELAGE. — All metal semi-monocoque structure, with bulkheads, centre-section spars, stringers and skin of aluminium alloy.

TAIL UNIT.—Conventional all-metal cantilever monoplane type. Areas: fin 12.4 sq. ft. (1.15 m.²), rudder 7.0 sq. ft. (0.65 m.²), elevators 14.34 sq. ft. (1.33 m.²), tailplane 26.96 sq. ft. (2.50 m.²). Tailplane span 12 ft. 9½ in. (3.9 m.).

LANDING GEAR.—Retractable tricycle type. Beech air-oil struts. Electric retraction. Single disc hydraulic brakes. Wheel track 9 ft. 8½ in. (2.96 m.). Wheelbase 12 ft. 5½ in. (3.79 m.).

POWER PLANT.—One Continental J69-T-9 turbojet engine (920 lb.=417 kg. s.t.). Two wing fuel tanks with total capacity of 180 U.S. gallons (681 litres).

ACCOMMODATION.—Tandem seats under a power-operated clamshell-type jettisonable canopy. Dual instrumentation, cockpit air conditioning and ejection seats optional.

DIMENSIONS.—
Span 32 ft. 9 in. (9.98 m.).
Length 30 ft. (9.15 m.).
Height 9 ft. 9½ in. (2.99 m.).

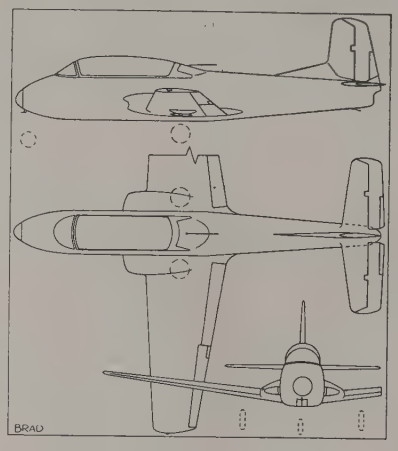
WEIGHTS.—
Weight empty 2,854 lb. (1,295 kg.).
Useful load 1,596 lb. (724 kg.).
Weight loaded 4,450 lb. (2,018 kg.).

PERFORMANCE.—
Max. speed 288 m.p.h. (463 km.h.).
Cruising speed 245 m.p.h. (394 km.h.).
Diving speed 500 m.p.h. (805 km.h.).
Service ceiling 26,600 ft. (8,105 m.).
Rate of climb at S/L. 1,440 ft./min. (440 m./min.).
Max. range with fuel reserve, 500 miles (805 km.).

THE BEECHCRAFT MODEL D50 TWIN-BONANZA.

U.S. Army designation: L-23E Seminole.

First of the American light twin-engined aircraft of post-war design, the prototype Twin-Bonanza flew on November 15, 1949. A number of Model D50 Twin-Bonanzas have been acquired by the U.S. Army Field Forces, under the designation L-23E. Earlier versions, still in service with the U.S. Army, have been described in previous editions of "All the World's Aircraft."



The Beechcraft Jet Mentor.

The following description applies to the standard commercial version of the D50.

TYPE.—Twin-engined six-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23014.1 at root, NACA 23012 at tips. Aspect ratio 7.51. Chord 78.15 in. (1.99 m.). Dihedral 7°. Incidence 5.8° at root, 1° at tip. All-metal two-cell, semi-monocoque box beam structure. Single slotted flaps and simple flap-type ailerons of magnesium sheet. Areas: flaps 37.8 sq. ft. (3.51 m.²), ailerons 13.89 sq. ft. (1.29 m.²). Gross wing area 277 sq. ft. (25.83 m.²).

FUSELAGE. — Conventional semi-monocoque metal structure with flush-riveted aluminium alloy skin.

TAIL UNIT.—Cantilever monoplane type. Slight dihedral to tailplane. All-metal structure. Tailplane and fin are of aluminium alloy. Rudder and elevator are covered in magnesium sheet. Areas: fin 14.25 sq. ft. (1.32 m.²), rudder 12.77 sq. ft. (1.18 m.²), tailplane 47.25 sq. ft. (4.39 m.²), elevators 17.49 sq. ft. (1.62 m.²). Tailplane span 16 ft. 4 in. (4.98 m.).

LANDING GEAR.—Retractable tricycle type. Electric actuation. Main shock-strut assemblies interchangeable on either side. Split type wheels. Single-disc hydraulic brakes. Nose wheel is steerable. Main wheel track 12 ft. 9 in. (3.88 m.). Wheelbase 10 ft. 9 in. (3.28 m.).

POWER PLANT.—Two Lycoming GO-480-C2D6 six-cylinder horizontally-opposed air-cooled engines, with 295 h.p. at 3,400 r.p.m. available at take-off and normal rating of 285 h.p. at 3,100 r.p.m. at S/L. Hartzell three-blade aluminium alloy, fully-feathering, constant-speed, hydraulically-controlled airscrews. Fuel capacity 180 U.S. gallons (681 litres) in two 44 gallon (166 litres) inboard wing tanks, two 23 gallon (87 litres) outboard wing tanks and two optional 23 gallon (87 litre) auxiliary wing tanks. Oil capacity 6 U.S. gallons (22.7 litres).

ACCOMMODATION.—Enclosed cabin seating a maximum of six; pilot, co-pilot and passenger on front seat 54 in. (1.37 m.) wide and three passengers on rear seat 52 in. (1.32 m.) wide. Optional five-seater has only two front seats, on a lateral track for right side or centre aisle. Two baggage compartments, one forward and one aft. A stretcher patient can be loaded through rear baggage door without need to climb on wing. Capacity of front baggage compartment 14 cub. ft. (0.4 m.³), rear compartment 41 cub. ft. (1.16 m.³). Equipment includes cabin sound-proofing, heating and ventilation, and choice of radio installations.

DIMENSIONS.—
Span 45 ft. 3⅜ in. (13.81 m.).
Length 31 ft. 6½ in. (9.61 m.).
Height 11 ft. 4 in. (3.46 m.).

WEIGHTS AND LOADINGS.—
Weight empty 4,070 lb. (1,846 kg.).
Weight loaded 6,300 lb. (2,858 kg.).
Wing loading 22.74 lb./sq. ft. (111.0 kg./m.²).
Power loading 11.05 lb./h.p. (5.01 kg./h.p.).

PERFORMANCE.—
Max. speed at 2,500 ft. (760 m.) 214 m.p.h. (344 km.h.).
Cruising speed (70%) power at 7,000 ft. (2,135 m.) 203 m.p.h. (327 km.h.).
Landing speed (full flaps) 71 m.p.h. (114 km.h.).
Rate of climb at S/L. 1,450 ft./min. (442 m./min.).
Single-engine climb at S/L. 300 ft./min. (91 m./min.).
Service ceiling 20,000 ft. (6,100 m.).
Single-engine ceiling 7,000 ft. (2,135 m.).
Max. range (at 160 m.p.h., no reserve) at 10,000 ft. (3,050 m.) 1,650 miles (2,655 km.).
Take-off to 50 ft. (15.25 m.) S/L. and no wind 420 yds. (385 m.).
Landing over 50 ft. (15.25 m.) no wind 484 yds. (442 m.).

THE BEECHCRAFT MODEL E50 TWIN-BONANZA.

U.S. Army designation: L-23D Seminole.

The Model E50 Twin-Bonanza and the equivalent U.S. Army version, the L-23D,



The Beechcraft Model E50 Twin-Bonanza (two 340 h.p. Lycoming GSO-480 engines).

have two Lycoming GSO-480-A1A6 supercharged engines for improved performance.

Otherwise the general structural description of the civil Model D50 Twin-Bonanza previously described applies to this aircraft.

Power Plant.—Two Lycoming GSO-480-A1A6 geared supercharged six-cylinder horizontally-opposed air-cooled engines with 340 h.p. at 3,400 r.p.m. available at take-off and normal rating of 320 h.p. at 3,200 r.p.m. at S/L. Fuel capacity 230 U.S. gallons (872 litres) in two 44 gallon (166 litre) inboard wing tanks, two 46 gallon (174 litre) outboard wing tanks and two optional 25 gallon (96 litre) auxiliary wing tanks. Oil capacity 8 U.S. gallons (30.25 litres).

Dimensions.—
As for Model D50.

Weights and Loadings.—
Weight empty 4,440 lb. (2,014 kg.).
Weight loaded 7,000 lb. (3,175 kg.).
Wing loading 25.2 lb./sq. ft. (123.03 kg./m.²).
Power loading 10.9 lb./h.p. (4.94 kg./h.p.).

Performance.—
Max. speed at 9,000 ft. (2,750 m.) 240 m.p.h. (386 km.h.).
Cruising speed (70% power) at 13,300 ft. (4,050 m.) 228 m.p.h. (367 km.h.).
Landing speed (full flaps) 80 m.p.h. (129 km.h.).
Rate of climb at S/L. 1,620 ft./min. (495 m./min.).
Single-engine climb at S/L. (at 6,000 lb.= 2,722 kg. A.U.W.) 445 ft./min. (136 m./min.).
Service ceiling 24,800 ft. (7,560 m.).
Single-engine ceiling (at 6,000 lb.=2,722 kg. A.U.W.) 15,500 ft. (4,730 m.).



The Beechcraft L-23D Seminole (two 340 h.p. Lycoming GSO-480 engines).

Tail Unit.—Conventional cantilever monoplane type with twin fins and rudders. Tailplane and fin of aluminium-alloy. Elevators and rudders have aluminium-alloy frames and fabric covered. Areas: fins 20.08 sq. ft. (1.86 m.²), rudders 13.5 sq. ft. (1.25 m.²), elevators 22 sq. ft. (2.04 m.²), tailplane 49.58 sq. ft. (4.61 m.²). Tailplane span 14 ft. 11½ in. (4.56 m.).

Landing Gear.—Tailwheel type. Geisse safety gear for cross-wind landings. Beech air-oil struts. Electric retraction. Integral single-disc brakes with controls for both pilot and co-pilot. Wheel track 12 ft. 11 in. (3.93 m.). Wheelbase 23 ft. 2 in. (7.06 m.).

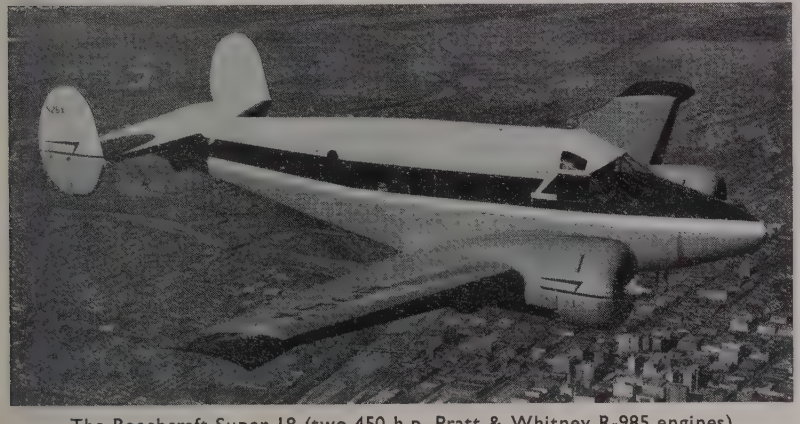
Power Plant.—Two 450 h.p. Pratt & Whitney R-985-14ANB radial air-cooled engines. Hamilton standard Hydromatic fully-feathering airscrews. Normal tankage comprises four wing tanks with a total capacity of 198 U.S. gallons (750 litres), and a nose tank with a capacity of 77 U.S. gallons (291 litres). Auxiliary wing tanks bring total available tankage to 318 U.S. gallons (1,205 litres).

Accommodation.—Pilot's compartment in nose, seating two side-by-side. Passenger cabin is separated from pilot's compartment by folding door and seats 5-7 passengers. Separate toilet-baggage compartment aft of cabin. Built-in steps, reclining seats, individual lighting and ventilation controls. Sound-proofing, controlled ventilation and heating. Refreshment bar and fold-away card tables optional.

Dimensions.—
Span 49 ft. 8 in. (15.14 m.).
Length 35 ft. 2⅛ in. (10.70 m.).
Height 9 ft. 6 in. (2.90 m.).

Weights and Loadings.—
Weight empty (equipped) 6,050 lb. (2,744 kg.).
Disposable load 3,250 lb. (1,474 kg.).
Weight loaded 9,300 lb. (4,218 kg.).
Wing loading 25.75 lb./sq. ft. (135.66 kg/m.²).
Power loading 10.32 lb./h.p. (4.68 kg./h.p.).

Performance.—
Max. speed 234 m.p.h. (374 km.h.) at 3,300 ft. (1,512 m.).
Cruising speed (66.7% METO) 207 m.p.h. (331 km.h.) at 5,000 ft. (1,525 m.), 215 m.p.h. (344 km.h.) at 10,000 ft. (3,050 m.).
Max. rate of climb at S/L. (8,750 lb.=3,970 kg. A.U.W.) 1,490 ft./min. (450 m./min.).
Service ceiling 23,300 ft. (7,106 m.).
Service ceiling on one engine (at 8,750 lb.= 3,970 kg. weight) 10,350 ft. (3,155 m.).
Range (260 h.p. at 10,000 ft.=3,050 m.) 1,626 miles (2,616 km.).
Take-off distance to 50 ft. (15.25 m.) at S/L. 600 yds. (549 m.).
Landing distance from 50 ft. (15.25 m.) at S/L. 566 yds. (418 m.).


The Beechcraft Super 18 (two 450 h.p. Pratt & Whitney R-985 engines).

Max. range at 169 m.p.h. (272 km.h.) no reserve at 10,000 ft. (3,050 m.) 1,650 miles (2,655 km.).
Take-off to 50 ft. (15.25 m.) at S/L. no wind 417 yds. (381 m.).
Landing from 50 ft. (15.25 m.), no wind 613 yds. (560 m.).

THE BEECHCRAFT SUPER 18.

The Super 18 is a larger, improved version of the civil Model D18S described in earlier editions of "All the World's Aircraft." It incorporates a number of structural and equipment improvements, including external drag reduction refinements, improved sound-proofing, a modified flight compartment, integral entrance steps, Geisse safety landing gear, etc. The first E18S prototype flew on December 10, 1953.

Type.—Twin-engined light Transport.

Wings.—Low-wing cantilever monoplane. Wing section modified NACA 23000 series. Aspect ratio 6.85. Chord 96.64 in. (2.45 m.). Dihedral 6°. Incidence 3.92°. All-metal two-spar structure, with the inboard half of the main spar built as a steel alloy truss. Ailerons and balanced flaps are fabric-covered with aluminium-alloy frames. Aileron area 17.48 sq. ft. (1.62 m.²). Flap area 28.12 sq. ft. (2.61 m.²). Gross wing area 361 sq. ft. (33.54 m.²).

Fuselage. — All-metal semi-monocoque structure with 24S-T aluminium-alloy frames, extruded stringers and skin.

THE BEECHCRAFT MODEL 1001 DRONE. U.S. Navy designation: XKDB-1.

The XKDB-1 pilotless remotely-controlled target drone, which won a U.S. Navy design competition in 1955, is the


The Beechcraft XKDB-1 Target Drone (120 h.p. McCulloch engine).

first product of Beech's recently-formed guided-missile division. Powered by a 120 h.p. McCulloch six-cylinder opposed two-stroke turbo-supercharged air-cooled engine, it is an all-metal high-wing monoplane with vee-tail, and is intended as an "out-of-sight" target for surface-to-air and air-to-air gunnery practice.

The XKDB-1 is designed for catapult-launching ashore and afloat, or for air-launching from a mother-plane. It has a recovery parachute and a watertight structure, so that it will float if it comes down on to water.

The U.S. Navy has placed an initial order for a small number of XKDB-1's, which will be built at Wichita. The first free flights were made at the U.S.N. Air Missile Test Center, Point Mugu, Calif., in the Spring of 1957.

DIMENSIONS.—
Span 12 ft. 6 in. (3.81 m.).
Length 13 ft. 6 in. (4.12 m.).

WEIGHT.—
Weight loaded 600 lb. (272 kg.).

PERFORMANCE.—
Max. speed over 320 m.p.h. (515 km.h.).
Service ceiling over 40,000 ft. (12,190 m.).
Endurance at altitude over one hour.

BELL

BELL AIRCRAFT CORPORATION.

HEAD OFFICE: P.O. Box 1, Buffalo 5, N.Y.

President and General Manager: Leston P. Faneuf.

First Vice-President: Ray P. Whitman.

Vice-President and Manager of Aircraft Division: Julius J. Domonkos.

Vice-President and Manager of Weapon Systems Division: Roy J. Sandstrom

Secretary and Treasurer: William G. Gisel.

Bell Aircraft Corpn. was formed in 1935 by Lawrence D. Bell, formerly Vice-President and General Manager of the Consolidated Aircraft Corpn., R. P. Whitman, who was Assistant General Manager of Consolidated, and the late Robert J. Woods, Consolidated's Chief Engineer. When Consolidated moved its factory from Buffalo to San Diego, Cal., these three men remained in Buffalo to form the new company, of which Lawrence Bell was still Chairman at the time of his death on October 20, 1956.

Bell started development of helicopters in addition to fixed-wing aircraft in 1941, and quickly became a leading company in the U.S. helicopter industry. On January 1, 1957, its Helicopter Division at Fort Worth, Texas, assumed full corporate status, becoming the Bell Helicopter Corporation, a wholly-owned subsidiary with responsibility for handling all the company's activities in the rotating wing field. The current products of the new Corporation are described separately after those of the parent company.

Two months earlier, in November, 1956, it was announced that the Niagara Frontier Division, established in World War II to encompass all Bell operations in the Buffalo-Niagara Falls area, had been reorganised into two new operating groups known as the Aircraft Division and the Weapon Systems Division, each with complete responsibility for design, production and sales of its own products.

The Bell X-2 research aircraft flew faster and higher than any aeroplane in history before it was destroyed in an accident on September 27, 1956. Built to study the thermal effects of supersonic flight, it was the last of a series of supersonic research aircraft produced by Bell for the U.S.A.F. and N.A.C.A. The first was the X-1, which became the World's first supersonic aeroplane in 1947. Three others, the X-1B, X-1E and X-5, are still being flown at Edwards Air Force Base, Calif., by N.A.C.A. pilots and have been described in earlier editions of "All the World's Aircraft."

Investigation of revolutionary new types of aircraft is under way in the Bell Aircraft Division. In addition, Bell is the only company in the United States which is manufacturing and investigating four concepts of vertical take-off aircraft. These are the helicopter, the tilting-rotor convertiplane, the jet-powered VTOL and the ducted-airscrew VTOL.

Following its successful development of a small jet-powered VTOL research aircraft, Bell now has a U.S.A.F. contract to develop the X-14, which uses the jet deflection technique.

The ducted-airscrew concept, although generally similar to the jet VTOL, has turboprop engines to provide the thrust to lift the aircraft vertically and propel it forward. The airscrews are surrounded by cowling or ducts and, as in the VTOL, the complete power plants are rotated for transition from vertical to horizontal flight. Military applications of this configuration are being studied.

Details of some of the company's guided missile and rocket propulsion activities were released in 1956-57, including first photographs of the GAM-63 Rascal air-to-ground missile which is in production for the U.S.A.F. and is described in the "Guided Missiles" section of this work.

In the rocket propulsion field Bell is delivering booster motors for the Douglas Nike missile, and is continuing in the research and development of high-thrust rocket power-plants.

The formation of a new nuclear engineering department, with responsibility beyond weapon systems assignments, was announced in April, 1956.

Also announced in 1956 was the Bell Automatic Carrier Landing System, which was developed under a U.S. Navy Bureau of Ships contract and is now the subject of both Navy and U.S.A.F. contracts. Combining radio and radar equipment with an electronic computer, it had been used for more than 1,200 completely automatic landings in all weather conditions by jet fighters, large transport aircraft and lightplanes at a number of airfields by the Spring of 1957.

Although developed originally for carrier-based aircraft, and scheduled for installation aboard a U.S. Navy carrier for all weather operational trials during 1957, the Automatic Carrier Landing System has much wider potential applications. It could, for example, be linked with a standard navigational system to make possible completely automatic flight by military and commercial aircraft under all weather conditions.

Bell is also engaged on extensive sub-contract work, with contracts for Boeing B-52 engine nacelles extending into 1959, and for major sub-systems for the Convair B-58.

Employment totalled 18,126 persons at the end of 1956, with 14,567 in the Aircraft and Weapon Systems Divisions and 3,559 in the Helicopter Division (now the Bell Helicopter Corporation) at Fort Worth, Texas.

THE BELL X-14.

The X-14 is an experimental vertical take-off aircraft of extremely simple design, which has been built under U.S.A.F. contract to continue the research work started by Bell as a private-venture three years ago with the tilting-power plant VTOL monoplane, which has been described in previous editions of "All the World's Aircraft."

The X-14 is an open-cockpit mid-wing monoplane of all-metal construction and is powered by two Armstrong Siddeley Viper turbojets mounted horizontally side-by-side in the fuselage nose. Thrust diverters are mounted behind the engines to deflect the jet efflux towards the ground during take-off and landing. In this way, the X-14 is able to raise itself vertically off the ground by direct jet lift, with its fuselage in the horizontal position.

At a safe height, the jet efflux is deflected slightly rearward, to produce forward thrust in addition to jet lift. When the forward speed is sufficient for the fixed wings to provide adequate lift, the efflux is re-directed towards the rear and the aircraft flies in a conventional manner. For vertical landing the pilot reverses the take-off technique.

During take-off, landing, hovering and flight at slow speeds, directional control is effected by means of compressed air nozzles at the wing-tips and tail, as on the original VTOL.

First hovering flight of the X-14 was made on February 19, 1957 and has been followed by further successful hovering and forward flights.

DIMENSIONS.—
Span 34 ft. (10.36 m.).
Length 25 ft. (7.62 m.).
Height 8 ft. (2.44 m.).

THE BELL X-2.

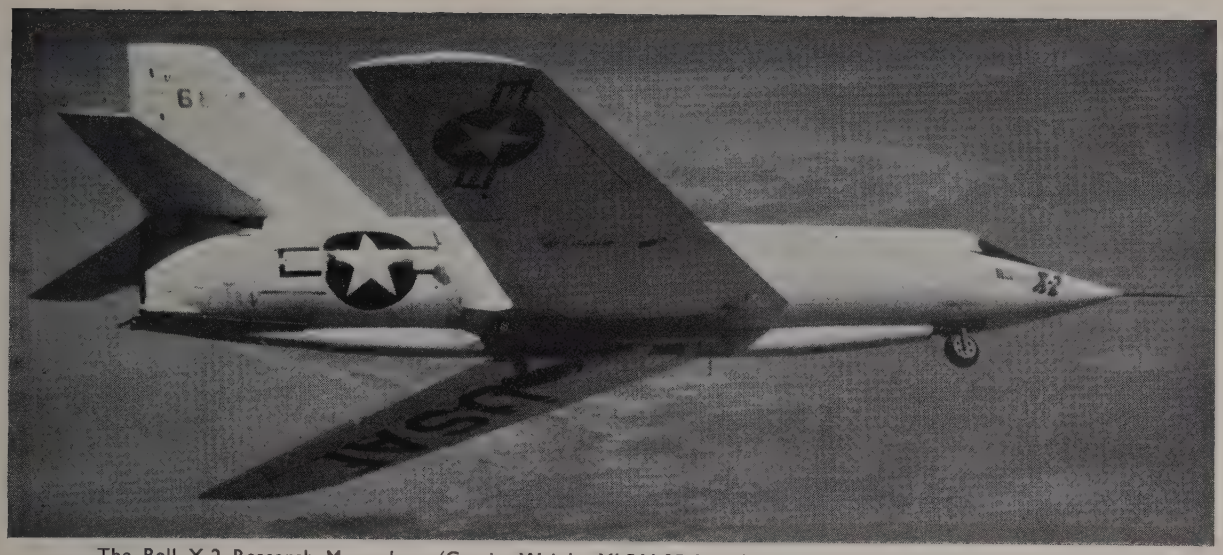
Two prototypes of the X-2 swept-wing rocket-powered research aircraft were developed jointly by Bell, the U.S.A.F. and the N.A.C.A. to explore the problems of transonic and supersonic flight.

The first X-2 was lost in May, 1954, when it was jettisoned from its B-50 carrier after being damaged by an explosion in the B-50.

The second X-2 made its first powered flight on November 18, 1955, piloted by Lt.-Col. F. Everest, U.S.A.F. This aircraft was destroyed in a fatal crash on September 27, 1956, after a flight in which



The Bell X-14 Experimental VTOL Monoplane (two Armstrong Siddeley Viper turbojets).



The Bell X-2 Research Monoplane (Curtiss-Wright XLRM-25 liquid-propellent throttleable rocket motor).

its pilot, Capt. Milburn Apt, U.S.A.F., was stated officially to have flown faster than any other human being has been known to fly.

The aircraft had stainless steel wings and tail, a K-monel metal fuselage and was powered by a 15,000 lb. (6,800 kg.) s.t. Curtiss-Wright XLRM-25 liquid propellent rocket motor, the first of its type to be fitted with throttle control.

A flat skid landing-gear permitted additional fuel to be carried in the space ordinarily occupied by wheels and retracting gear.

The pilot's cockpit was heavily insulated and pressurised, and was detachable. In an emergency at high altitude the entire cockpit was designed to be separated from the rest of the aircraft by explosive charges and carried by a ribbon parachute to a lower altitude where the pilot could make a normal bale-out.

No details of the precise performance of the X-2 have been released officially. Unofficially it has been reported that the X-2 had been flown at a speed exceeding Mach 3.1 or 2,060 m.p.h. (3,315 km.h.) and had reached an altitude of some 126,000 ft. (38,430 m.) or just under 24 miles.

No further details are available.

BELL HELICOPTER CORPORATION.

HEAD OFFICE: P.O. Box 482, FORT WORTH, TEXAS.

President: Harvey Gaylord.

Vice-President and Contracts Director: G. B. Clark.

Vice-President and Manufacturing Manager: Roy Coleman.

Vice-President: E. J. Ducayet.

Vice-President and Secretary: W. G. Gisel.

Vice-President and Chief Helicopter Engineer: Bart Kelley.

Treasurer: J. F. Atkins.

Formerly the Helicopter Division of Bell Aircraft Corpn., the Bell Helicopter Corpn. became a separate wholly-owned subsidiary of that company on January 1, 1957 and is responsible for all Bell activities in the rotating wing field.

Bell was early in the field in helicopter development. Following two years' development work, an experimental Model 30 was flying in 1943, and this craft was superseded late in 1945 by the first of the Model 47 Series. This helicopter received the first helicopter Approved Type Certificate from the C.A.A. on March 8, 1946, since when the Model 47 has been in continuous production in both military and commercial forms.

Present production at Fort Worth is concerned mainly with new models of the Bell 47 and experimental and development work with various craft of advanced design. These include the XH-40 turbine-powered helicopter and the XV-3 experimental convertiplane. In addition, the company has been awarded U.S. Army design study contracts for a lightweight two-seat observation helicopter and a large "flying crane" helicopter capable of lifting loads of up to 16 tons.

Since the delivery of the first commercial Model 47 in December, 1946, more than 1,800 Bell helicopters have been bought by the U.S. armed forces and by commercial operators in the United States and abroad.

THE BELL MODEL 212.
U.S. Army designation: XH-40 Iroquois.

In 1955 Bell won an Army Competition for the development of a utility helicopter to be suitable for front-line evacuation of casualties, general utility missions and as an instrument trainer.

Known as the XH-40, the new aircraft is powered by a Lycoming T53 free power shaft turbine which develops 825 s.h.p. and is capable of running on a wide variety of fuels, including JP-4, all-purpose automotive, aviation spirit and kerosene. Three prototypes are being built, of which the first flew for the first time on October 22, 1956. In addition, an initial order for seven YH-40 service test models has been received, and this is expected to be followed by a full production contract, with deliveries to begin in 1959. The type has been named Iroquois.

TYPE.—Six-seat utility Helicopter.

ROTORS.—Two-blade main rotor and two-blade anti-torque tail rotor. Usual Bell-type stabilising bar below and at right angles to main rotor. Underslung feathering axis hub. Rotor shaft-driven by gas-turbine engine. Main rotor disc area 1,520 sq. ft. (141.2 m.²).

FUSELAGE.— All-metal semi-monocoque structure.

LANDING GEAR.—Tubular skid type.

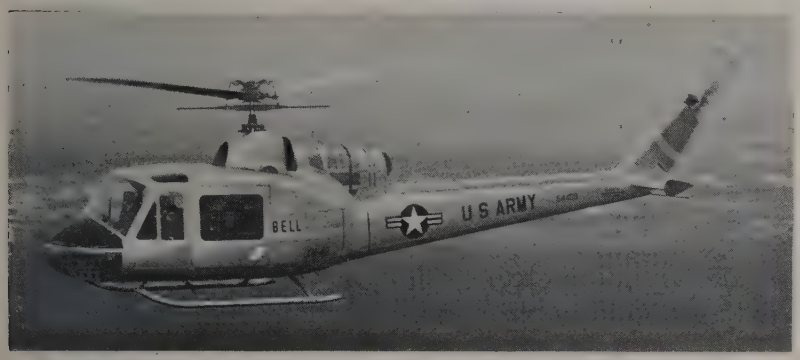
POWER PLANT.—One 825 s.h.p. (derated to 700 s.h.p.) Lycoming T53 shaft-turbine mounted above fuselage to rear of cabin.

ACCOMMODATION.—Pilot and five passengers, or stretchers, or freight in totally-enclosed cabin, with two doors on each side.

DIMENSIONS.—
Diameter of main rotor 44 ft. (13.4 m.).
Max. length 57 ft. (17.37 m.).
Height 11 ft. 1 in. (3.38 m.).

WEIGHTS.—
Empty weight 3,344 lb. (1,517 kg.).
Normal gross weight 5,194 lb. (2,356 kg.).
Max. gross weight 5,619 lb. (2,549 kg.).

PERFORMANCE (Estimated).—
Max. speed 152 m.p.h. (245 km.h.).
Hovering ceiling 19,000 ft. (5,790 m.).
Rate of climb at S/L. 1,900 ft./min. (579 m./min.).
Normal range 202 miles (325 km.).



The Bell XH-40 Utility Helicopter (825 s.h.p. Lycoming T53 shaft-turbine).

THE BELL MODEL 200.
U.S. Army designation: XV-3.

The XV-3 is an experimental convertiplane which has been developed by Bell and the U.S.A.F. Research and Development Command for the U.S. Army under a joint Army-Air Force contract.

The XV-3 convertiplane, which was originally designated XH-33, is of the tilting-rotor type and combines the features of both the helicopter and the aeroplane.

Two combination rotor/propellers, mounted near the tips of the fixed wing, operate as conventional lifting rotors during take-off, landing and low-speed

flight and as aircraft propellers for horizontal cruise and high-speed flight.

The tilting of the rotors is by electric motors enclosed in fairings at the wing tips and their movement through their full range from horizontal to vertical attitudes can be accomplished in from 10 to 15 seconds. The pilot can stop or reverse the conversion at any point, steady stable flight being maintained with the rotor/propellers in any intermediate position.

Originally, three-blade articulated rotors were fitted, but tests of a new two-bladed semi-rigid rotor system, with underslung feathering axis hubs, were started early in 1957.

Power is supplied by a Pratt & Whitney R-985 engine located behind the cabin, which seats four. An improved version of the Bell helicopter-type skid landing gear is fitted.

As a helicopter, the XV-3 will be capable of hovering or flying forward, backward or sideways, and will be able to operate into and out of confined areas. As an aeroplane the XV-3 will operate as a medium-range aircraft with a maximum speed of 160 m.p.h. (258 km.h.) at 2,500 ft. (760 m.).

The first XV-3 made its first vertical flight on August 23, 1955, and had successfully made 15° conversions in flight before it was badly damaged in a crash landing on October 25, 1956. Development is being continued with the second XV-3.



The Bell XV-3 Experimental Convertiplane (Pratt & Whitney R-985 engine).



The Bell Model 47G-2 Utility Helicopter (200 h.p. Lycoming engine).

DIMENSIONS.—
Diameter of rotors 25 ft. (7.62 m.).
Span of fixed wings 30 ft. (9.15 m.).
Length of fuselage 30 ft. (9.15 m.).
Height 13 ft. 6 in. (4.11 m.).
Rotor disc area 982 sq. ft. (91.23 m.²).

THE BELL MODEL 47G AND 47G-2.
U.S.A.F. designation: H-13.
U.S. Army name: Sioux.
U.S. Navy designation: HTL.

Since it delivered its first Model 47 in January, 1947, Bell has produced eight commercial models. They are the 47B, which had an enclosed, automobile-type cabin; the 47B-3, which had an open cockpit; the 47D, which had an all-Plexiglas cabin for greater visibility, plus weather protection, the 47D-1, the 47G and 47G-2, 47H and 47J.

The model 47H, a de luxe version of the 47G, and the model 47J, a four-seat utility version of the 47G are described separately.

Compared with the earlier versions, the 47G has a small elevator which is geared to work in conjunction with rotor tilt. This permits an increase in permissible C.G. travel and greatly improves stability. There are two versions as follows :—

Model 47G. Standard model with 200 h.p. Franklin 6V4-200-C32 engine.

Model 47G-2. Similar to 47G, but with Lycoming VO-435 engine, derated to 200 h.p. This permits maximum power to be maintained to 5,000 ft. (1,525 m.) and offers longer engine life.

The following are the current military versions of the 47G and 47G-2.

XH-13F. (Bell Model 201). This is an experimental craft powered by a Continental-Turbomeca T51-T-3 Artouste shaft turbine engine.

H-13G. Military version of standard 47G. Can carry two external litters.

H-13H. Military version of 47G-2. Total of 189 ordered by U.S. Army, with stretcher evacuation kits, two radios, dual controls, new-type skid landing gear and all-metal rotor blades. An H-13H set up an international helicopter endurance record of 57 hr. 50 min. in 1956, by refuelling whilst hovering just clear of the ground at regular intervals.

H-13J. See under Bell Model 47J.

HTL-6. Naval training version of 47G. All supplied with skid landing-gear but float kits provided for proportion.

HTL-7. See under Bell Model 47J.

The description which follows refers specifically to the three-seat utility model 47G.

TYPE.—Three-seat General Utility Helicopter.

ROTORS.—Two-blade main rotor and controllable-pitch anti-torque rotor. Main rotor hub mounted on transmission mast by universal joint and provided with a stabilizing bar below and at right angles to the blades. A swash-plate revolving with the mast but free to move up and down provides cyclic pitch-control. Lower half of swash-plate which does not revolve alters pitch of the blades differentially for directional control. Main rotor drive through a centrifugal clutch and a two-stage planetary transmisson with a 9 : 1 reduction ratio. Free-wheeling mechanism incorporated in transmission. Transmission furnishes power take-offs for tail rotor drive, cooling fan and accessories and pulleys. Main rotor blades of symmetrical aerofoil section, are of laminated wood with a steel insert in leading-edge for strength and mass-balance. Blade area (each) 17.67 sq. ft. (1.64 m.²). Disc area 965 sq. ft. (89.65 m.²). Pre-coning angle 2.5 degrees. Metal anti-torque rotor blades. Blade area (each) 1.2 sq. ft. (0.11 m.²). Disc area 25.31 sq. ft. (2.35 m.²).

FUSELAGE.—In three sections; centre, tail and cabin. Centre section has a welded tubular steel framework which provides for mounting the engine and supports the cabin. Rear section is also a tubular structure, is triangular in cross-section and serves as a support for the anti-torque rotor drive-shaft. Small synchronised elevator surface at rear end of fuselage responds to the fore and aft motion of the cyclic-pitch control, provides better stability and allows a greatly increased C.G. travel.

LANDING GEAR.—Tubular skid type. Skid tread 7 ft. 6 in. (2.28 m.). Small ground handling wheels and tie-down and towing attachments provided. Four-wheel landing-gear may be supplied for training and



The Bell H-13H Utility Helicopter (200 h.p. Lycoming VO-435 engine).

other missions requiring considerable handling. The two forward self-castoring wheels capable of swivelling through 360°, the two rear wheels fixed. Wheel track 5 ft. 10¼ in. (1.78 m.). For amphibious use two air-inflated nylon floats are easily attached.

POWER PLANT.—One vertically-mounted 200 h.p. Franklin 6V4-200-C32AB (0-355-5) six-cylinder horizontally-opposed fan-cooled engine with clutch, drive shaft and rotor assembly in an integral unit in a steel-tube framework with the engine supported in rubber mounts at the top and bottom and attached to the welded framework of the forward fuselage. The engine-mounting structure has three attachment points for the rear fuselage. Engine controls include throttle, carburettor, hot air and carburettor mixture. The throttle is located on the main rotor pitch control lever and drives through a cam which automatically compensates for varying power requirements as the main rotor pitch control lever is actuated. Two interconnected saddle-mounted fuel tanks (43 U.S. gallons = 172.5 litres total capacity) on C.G. and with gravity feed.

ACCOMMODATION.—Side-by-side seating for three in enclosed compartment. The compartment is covered by a full-blown Plexiglas canopy with doors attached. For fair weather or specialised operations the doors are quickly removable. Can carry 465 lb. (211 kg.) cargo instead of passengers.

CONTROLS.—Conventional control stick for tilting main rotor by cyclic rotor blade angle change. Adjustable friction device on stick used to regulate control sensitivity. Main rotor pitch control lever located at left side of each seat. Rudder pedals connected to pitch-changing mechanism on tail rotor for torque compensation and directional control.



The Bell Model 47H-1 Bellairus (200 h.p. Franklin engine).

PERFORMANCE (Model 47G-2).—
Max. speed 100 m.p.h. (161 km.h.).
Hovering ceiling in ground effect 15,700 ft. (4,785 m.).
Range 251 miles (404 km.).

THE BELL MODEL 47H-1 BELLAIRUS.

The Model 47H-1 is a de-luxe version of the 47G. It has an enclosed sound-proofed cabin 60 in. (1.525 m.) wide which can accommodate a pilot and two passengers on an automobile-type cross seat. Interior appointments include leather upholstery throughout and a leather-covered instrument console grouping all electrical switches and carburettor controls to the left of the pilot. A metal monocoque tail-boom contains a baggage compartment large enough to carry luggage for all occupants. Can be adapted to carry 398 lb. (180 kg.) of cargo instead of passengers.

The rotor-system, power-plant, hydraulic boost control and synchronised elevator are the same as for the Model 47G.

DIMENSIONS.—
As for Model 47G, except height 9 ft. 3 in. (2.82 m.).

WEIGHTS.—
Weight empty 1,502 lb. (681 kg.).
Weight loaded 2,350 lb. (1,067 kg.).

PERFORMANCE.—
Max. speed 100 m.p.h. (161 km.h.).
Cruising speed approx. 95 m.p.h. (152 km.h.).
Rate of climb 830 ft./min, (253 m./min.).
Hovering ceiling in ground effect 9,900 ft. (3,020 m.).
Absolute ceiling 14,800 ft. (4,520 m.).
Normal range 219 miles (352 km.).



The Bell Model 47J Ranger (240 h.p. Lycoming VO-435 engine).

THE BELL MODEL 47J RANGER.
U.S.A.F. designation: H-13J.
U.S. Navy designations: HUL-1 and HTL-7.

The Model 47J is a four-seat utility version of the 47G. The enclosed cabin seats the pilot centrally in front, with three passengers on a cross bench aft. The passenger seat can be removed to allow for the installation of two stretchers on a parallelogram rack such as is used in typical Army field ambulances, plus a jump seat for a medical attendant; with the port door removed a trap can be raised to permit use of an internal electrically-powered hoist for rescue work; or the passenger seat can be folded back to leave clear space for cargo. Conversion to any of the cabin configurations can be made in the field in a matter of minutes without the use of tools.

The 47J is powered by a Lycoming VO-435 engine de-rated to develop a maximum of 240 h.p.

EQUIPMENT.—Standard equipment includes complete VFR flight and engine instruments, hydraulic boost control, 28-volt/50 amp. generator, electric starter, ground handling wheels, heavy-duty battery, etc. Additional accessories available in CAA-approved kits include floats, night flying equipment, dusting and spraying equipment, cargo carriers, dual controls, etc.

DIMENSIONS.—
Diameter of main rotor 35 ft. 1½ in. (10.72 m.).
Overall length (main rotor fore-and-aft) 41 ft. 5 in. (12.62 m.).
Length of fuselage (tail rotor vertical) 27 ft. 4 in. (8.33 m.).
Width (over torsion bar) 8 ft. 6 in. (2.59 m.).
Height 9 ft. 5 in. (2.87 m.).
Diameter of tail rotor 5 ft. 8 in. (1.72 m.).

WEIGHTS (Model 47G).—
Weight empty (standard 2 or 3 seater) 1,435 lb. (651 kg.).
Max. certificated weight 2,350 lb. (1,067 kg.).

WEIGHTS (Model 47G-2).—
Weight empty 1,564 lb. (709 kg.).
Weight loaded 2,450 lb. (1,111 kg.).

PERFORMANCE (Model 47G at 2,200 lb. = 1,000 kg. A.U.W.).—
Max. speed 100 m.p.h. (161 km.h.).
Cruising speed 80 m.p.h. (128 km.h.).
Max. rate of climb at S/L. 910 ft./min. (277 m./min.).
Time to 5,000 ft. (1,525 m.) 7 min.
Service ceiling 12,200 ft. (3,720 m.).
Absolute ceiling 13,700 ft. (4,180 m.).
Hovering ceiling in ground effect 8,600 ft. (2,620 m.).
Range 247 miles (398 km.).
Endurance 3.9 hours.



The Bell H-13J, one of two supplied for Presidential use.

Three military versions have been announced, as follows :—

H-13J. Two for use by President Eisenhower. Equipped to carry three persons. Specially furnished.

HUL-1. Standard Model 47J in production for general utility and ice breaker patrol duties with U.S. Navy. Alternative pontoon landing gear.

HTL-7. Training version for U.S. Navy, ordered into production in 1957. Has HUL-1 airframe from the firewall back, with completely re-styled cabin containing all-weather flight instruments and side-by-side seating for pilot and co-pilot. The Navy will use this helicopter for both basic flying and instrument training, eliminating present need for two different types. Eighteen ordered, with delivery scheduled to begin in December, 1957.

DIMENSIONS.—
Diameter of main rotor 37 ft. 2 in. (11.33 m.).
Overall length (main rotor fore and aft) 43 ft. 4 in. (13.2 m.).
Height 9 ft. 4 in. (2.84 m.).

WEIGHTS.—
Weight empty 1,618 lb. (734 kg.).
Max. loaded weight 2,800 lb. (1,270 kg.).

PERFORMANCE.—
Max. speed 105 m.p.h. (169 km.h.).
Cruising speed 95-100 m.p.h. (152-140 km.h.).
Hovering ceiling in ground effect 15,000 ft. (4,570 m.).
Normal range 214 miles (344 km.).

THE BELL MODEL 61.
U.S. Navy designation: HSL-1.

The HSL-1 is a large tandem-rotored helicopter which was designed specifically for anti-submarine warfare. The prototype flew on March 4, 1953, followed within a year by the first production type HSL-1's for the U.S. Navy.



The Bell HUL-1 Naval Helicopter (240 h.p. Lycoming VO-435 engine).

The tandem-rotored HSL-1 marks the Bell company's first departure from its familiar single-rotor configuration which has been used in all Bell helicopters since 1942. Each of the two rotors incorporates the basic Bell rotor principles, characterised by the rigid two-blade rotor and automatic stabilising bar. The fore and aft rotors are interconnected and power is supplied by a 1,900 h.p. Pratt & Whitney R-2800-50 engine in a buried installation. The rotors can be folded to enable the helicopter to negotiate the elevators in aircraft-carriers or other types of ship. Total fuel capacity is 425 U.S. gallons (1,610 litres).

The HSL-1 is equipped with dipping sonar for submarine detection and is armed with lightweight homing weapons for the destruction of undersea craft. A Bell-developed helicopter auto-pilot permits the HSL-1 to hover motionless for long periods during a search operation.

The HSL-1 carries a crew of four, a pilot, co-pilot and two sonar operators. It has a flight endurance of nearly four hours and maximum speed of 115 m.p.h. (185 km.h.) at sea level.

DIMENSIONS.—
Rotor diameter (both) 51 ft. 6 in. (15.7 m.).
Length of fuselage 39 ft. 2¾ in. (11.9 m.).
Overall height (over rear rotor pylon) 14 ft. 6 in. (4.4 m.).
Width (rotors folded) 11 ft. 8½ in. (3.5 m.).
Rotor disc area 4,170 sq. ft. (387.4 m.²).

WEIGHT.—
Loaded weight 26,500 lb. (12,020 kg.).



The Bell HSL-1 Anti-Submarine Helicopter (1,900 h.p. Pratt & Whitney R-2800 engine).

BENSEN

BENSEN AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS : RALEIGH-DURHAM AIRPORT, RALEIGH, NORTH CAROLINA.

President : Igor B. Bensen.

The Bensen Aircraft Corporation was formed by Mr. Igor B. Bensen, formerly Chief of Research of the Kaman company, to develop a series of lightweight helicopters and rotary-wing gliders.

Bensen built in 1953 a single-seat ramjet-powered research helicopter known as the Model B Mid-jet. This was followed in 1955 by the Model B-4 Sky-Scooter, which represented one of the first attempts to develop a simple, inexpensive and easy-to-fly sporting helicopter. It had a 40 h.p. engine mounted above the rotor head and driving two propellers mounted mid-way along each blade of the two-bladed rotor.

Production is now centred on the B-7 Gyro-Glider, a simplified rotor-kite which is being built in large numbers by amateur constructors in the United States. Also in production are the Model B-7W Hydro-Glider, the Model B-7B Gyro-Boat and the Model B-7M Gyro-Copter powered by a 40 h.p. Nelson engine. All four versions are described hereafter.

THE BENSEN MODEL B-7 GYRO-GLIDER.

The Gyro-Glider is a simple unpowered single-seat rotor-kite which can be towed behind even a small motor car. It is available as either a completed aircraft or kit of parts for amateur construction. Alternatively, would-be constructors can purchase a set of plans, with building and flying instructions. No pilot's licence is required to fly it in the United States and many hundreds of kits and plans have been sold. Application has been made for an Approved Type Certificate.

The Model B-7 consists basically of an inverted tubular aluminium T-frame structure, of which the forward arm supports the lightweight seat, towing arm, rudder bar and landing gear nose-wheel. The rear arm supports a large stabilising fin and rudder, with the main landing gear wheels carried on a tubular axle at the junction of the T-frame. The free-turning two-bladed rotor is universally-mounted at the top of the T-frame and is operated directly by a hanging-stick control. It is claimed that the entire aircraft can be made from commercial tubing, wood and locally-available materials.

THE BENSEN MODEL B-7W HYDRO-GLIDER.

The basic structure of this floatplane rotor-kite is similar to that of the B-7 Gyro-Glider and conversion from one to the other is simple. Main changes are that the nose-wheel landing gear is replaced by three floats, the rear pair of which are built integrally with twin stabilising fins. It is towed by a motor-boat.

THE BENSEN B-7B GYRO-BOAT.

The Gyro-Boat is a further variant of the Gyro-Glider, in which the basic free-turning rotor system, known as the Roto-sail, is mounted on any standard small dinghy. The result is literally a flying boat, intended to be towed above water by a motor boat.

The two-blade steel and plywood rotor has a diameter of 20 ft. (6.10 m.) and disc area of 314 sq. ft. (29.2 m.²). Each blade has an area of 10.8 sq. ft. (1.0 m.²). When fitted to a 12 ft. (3.66 m.) aluminium dinghy weighing 100 lb. (45 kg.), the complete Gyro-boat has an empty weight of 150 lb. (68 kg.) and a loaded weight of 325 lb. (147 kg.) carrying one person or 500 lb. (227 kg.) carrying two people.

It takes off when towed at a forward speed of 23 m.p.h. (37 km.h.), cruises at 35-70 m.p.h. (55-110 km.h.) and lands at 7 m.p.h. (11 km.h.).

The prototype Gyro-Boat flew for the first time on April 25, 1956, and the first production model on July 8, 1956.

THE BENSEN MODEL B-7M GYRO-COPTER,

First flown on December 6, 1955, the Gyro-Copter is a powered autogyro conversion of the Model B-7 Gyro-Glider, designed for home-construction from kits or plans. The prototype took off after only two taxying trials, and, in its initial tests rose to 300 ft., demonstrating its manoeuvrability in figure-8 turns, cross-wind landings and take-offs and formation flying with two standard U.S. Army helicopters in winds up to 29 m.p.h. (46 km.h.).



The Bensen Model B-7M Gyro-Copter (40 h.p. Nelson H-59 engine).

Power is provided normally by a 40 h.p. Nelson H-59 four-cylinder, horizontally-opposed air-cooled two-stroke engine, driving a two-blade wooden fixed-pitch propeller: but the Triumph 650 cc. motor-cycle engine is an approved alternative power plant for export models of the Gyro-Copter. The rotor is free-turning and, being permanently in the autorotation pitch range, needs no pitch change in the event of engine failure.

A modification that will enable the Gyro-Copter to take off and land vertically is under development.

Controls consist only of a hanging stick, rudder pedals and throttle. A fixed one-piece tailplane is fitted to compensate for reduced fin area, and a fuel tank with a capacity of 6 U.S. gallons (22.5 litres) is provided. Conversion of a Gyro-Glider to power can be made in one day. Optional equipment will include float landing gear, radio, enclosed cabin and heater.

DIMENSION.—
Rotor diameter 20 ft. (6.10 m.).

WEIGHTS.—
Weight empty 185 lb. (83.92 kg.).
Payload 250 lb. (113.4 kg.).

PERFORMANCE.—
Cruising speed 60 m.p.h. (97 km.h.).
Min. speed in still air 19 m.p.h. (30.5 km.h.).
Ceiling (estimated) 12,000 ft. (3,660 m.).
Area required for landing and take-off 100 ft. × 100 ft. (30.5 m. × 30.5 m.).
Range 120 miles (193 km.).

BILLMAN

BILLMAN AVIATION COMPANY.

ADDRESS: MAYFIELD, NEW YORK.

This company was formed by Mr. Owen S. Billman, who has designed and built on his own a light aeroplane known as the Billman Model B.11 Little Pink Cloud, which made its first flight on August 29, 1955.

Work on the Model B.11 began as a result of Mr. Billman's membership of the Experimental Aircraft Association, which was founded to foster the design and construction of aircraft by the home craftsman. The B.11 is licenced in the "Experimental" category under U.S. Civil Air Regulation 1,74-3.

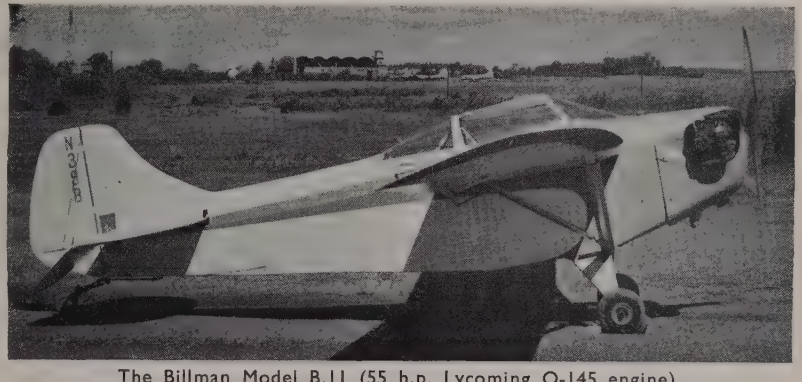
THE BILLMAN MODEL B.11 LITTLE PINK CLOUD.

TYPE.—Single-seat Light monoplane.

WINGS.—Shoulder-wing braced monoplane. Wing section Clark Y. Aspect ratio 6. Chord 4 ft. 2 in. (1.27 m.). Dihedral 3°. Incidence 1°. Single-spar spruce wood structure with fabric covering, except for aluminium alloy leading edge. Vee streamlined bracing struts to lower longerons of fuselage. Frise type ailerons with aluminium structure and fabric covering. No flaps. Total area of ailerons 15.4 sq. ft. (1.43 m.²). Gross wing area 97 sq. ft. (8.01 m.²).

FUSELAGE.—Welded steel tube structure, with aluminium fairing strips and fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel tube structure with fabric covering. Fin integral with fuselage. Areas: fin 4.6 sq. ft. (0.43 m.²), rudder 5.0 sq. ft. (0.46 m.²), elevators 8.0 sq. ft. (0.74 m.²), tailplane 9.7 sq. ft. (0.80 m.²). Tailplane span 8 ft. (2.44 m.).



The Billman Model B.11 (55 h.p. Lycoming O-145 engine).

LANDING GEAR.—Fixed tail-wheel type, with two Vees and two half axles hinged to bottom longerons. Elastic cord shock absorption. Hayes wheels and brakes. Wheel track 5 ft. 10 in. (1.78 m.).

POWER PLANT.—One 55 h.p. Lycoming O-145-A2 four-cylinder horizontally-opposed air-cooled engine driving wooden two-blade Sensenich airscrew. Fuel tank aft of engine firewall, capacity 12 U.S. gallons (45 litres). Oil capacity 5 U.S. quarts (4.5 litres).

ACCOMMODATION.—Single seat under rearward-sliding plexiglas canopy. Entry by means of stirrup step on lower port longeron and walkway at root of port wing. Baggage compartment aft of seat.

DIMENSIONS.—
Span 24 ft. 3 in. (7.39 m.).
Length 17 ft. 6 in. (5.33 m.).
Height 5 ft. 2 in. (1.57 m.).

WEIGHTS AND LOADINGS.—
Weight empty 630 lb. (286 kg.).
Weight loaded 880 lb. (399 kg.).
Wing loading 9 lb./sq. ft. (43.9 kg./m.²).
Power loading 16 lb./h.p. (7.26 kg./h.p.).

PERFORMANCE.—
Max. speed 115 m.p.h. (185 km.h.).
Cruising speed 98 m.p.h. (158 km.h.).
Stalling speed 50 m.p.h. (80.5 km.h.).
Rate of climb at S/L. 450 ft./min. (137 m./min.).
Range 300 miles (483 km.).

BOEING

THE BOEING AIRPLANE COMPANY.

HEAD OFFICE: SEATTLE 24, WASH.

AIRCRAFT MANUFACTURING DIVISIONS: SEATTLE, WASH., AND WICHITA, KANSAS.

OTHER DIVISIONS: PILOTLESS AIRCRAFT DIVISION, INDUSTRIAL PRODUCTS DIVISION AND TRANSPORT DIVISION, ALL AT SEATTLE, WASH.

Established: July, 1916.

Chairman: C. L. Egtvedt.

President: William M. Allen.

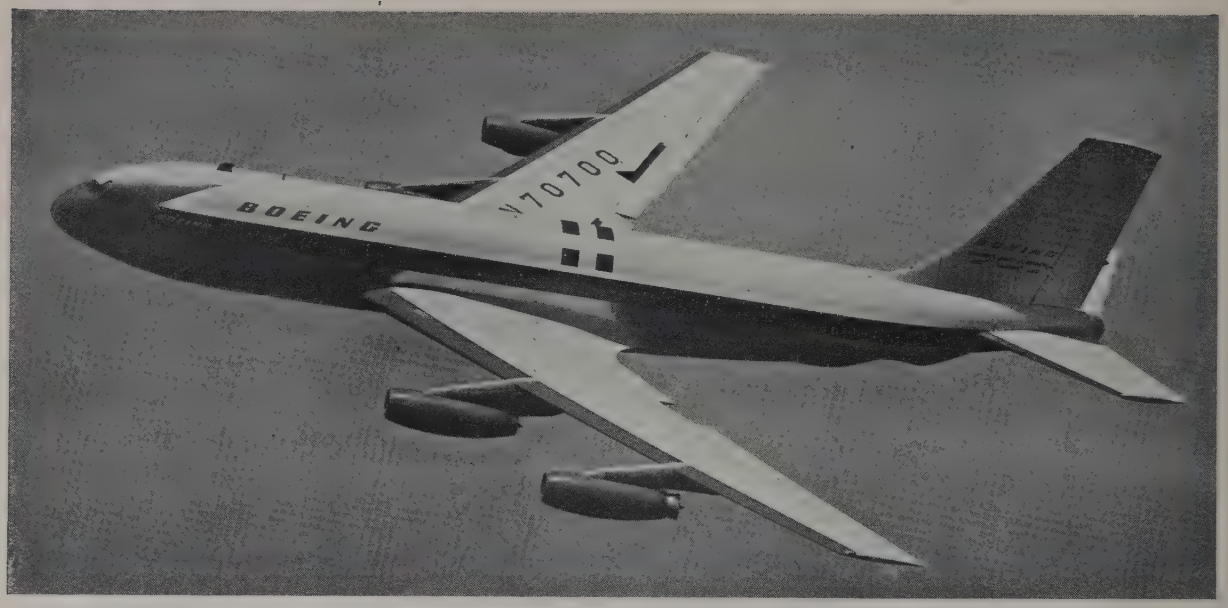
Senior Vice-President: Wellwood E. Beall.

Vice-President in charge of Engineering: Edward C. Wells.

Vice-President in charge of Manufacturing: F. P. Laudan.

Vice-President in charge of Industrial Relations: A. F. Logan.

Vice-President in charge of Finance: J. O. Yeasting.



The Boeing Model 707-80 which has served as prototype for both the KC-135 tanker and the civil 707 airliner.

Vice-President in charge of Administration and Secretary : J. E. Prince.

SEATTLE DIVISION.

Vice-President and General Manager : C. B. Gracey.

Chief Engineer : G. C. Martin.

PILOTLESS AIRCRAFT DIVISION.

Vice-President and Chief Engineer : L. A. Wood.

Chief Engineer : R. H. Jewitt.

TRANSPORT DIVISION.

Vice-President and General Manager : J. B. Connelly.

Chief Engineer : M. L. Pennell.

WICHITA DIVISION.

Vice-President and General Manager : J. E. Schaefer.

Chief Engineer : T. E. Gamlen.

Vice-President and Eastern Representative : J. P. Murray.

Treasurer : Evan M. Nelsen.

Controller : Clyde Skeen.

At the beginning of 1957 the Boeing Airplane Company was engaged in production of the B-52 eight-jet heavy bomber ; the KC-135 Stratotanker jet tanker-transport ; and the Model 707 Stratoliner jet airliner. It was also developing under U.S.A.F. contract an advanced type of bomber under the weapons system designation WS-110A.

The KC-135, which is a developed version of the Model 707, was ordered into production in September, 1954, and will be the standard aerial tanker for the B-52 wings of the U.S.A.F. Strategic Air Command. The first KC-135 made its first flight on August 31, 1956, and over 400 will be built.

In July, 1955, the U.S.A.F. advised Boeing that it had no objection to the company building commercial jet aircraft concurrent with military production. The company was ready to offer commercial versions of the Model 707 Stratoliner and by mid-1957 firm orders for these totalled 151 aircraft, for airlines in the United States and overseas. The first Stratoliners are due to start CAA flight tests in February 1958, and to receive CAA certification in December, 1958.

B-52 production is now under way at both Seattle and Wichita. The first B-52's were delivered to Strategic Air Command in June, 1955 and began replacing the B-36 in April, 1956. It will take several years, possibly until late 1959, to fully equip all heavy bomber wings of SAC with B-52's.

Production of the smaller B-47 Stratojet was phased-out at Boeing-Wichita in October, 1956, and this type is no longer in production.

Production of the KC-97 Stratofreighter at the government-owned Boeing-operated factory at Renton, near Seattle, was phased out as production of the KC-135 got under way in 1956. 888 Stratofreighters were built and the completion of the last one ended Boeing's production of piston-engined aircraft. In addition to the KC-135, all versions of the Model 707 Stratoliner will be built at Renton.

Boeing's Pilotless Aircraft Division was formed early in 1953 and is engaged in development of the IM-99 Bomarc supersonic interceptor missile, of which photographs and brief details were released in May, 1957.

Boeing has been awarded an Air Force contract for an "engineering study of the application of nuclear power-plants to aircraft." Under the contract Boeing is working in close co-operation with Pratt & Whitney Aircraft.

At the end of 1956, employment at the various Boeing plants totalled approximately 50,000 at the Seattle division and 30,000 at Wichita.

THE BOEING MODEL 707.

U.S. Air Force designation: KC-135.

The Boeing Model 707 was the first American jet transport to be completed and flown. It made its first flight on July 15, 1954.

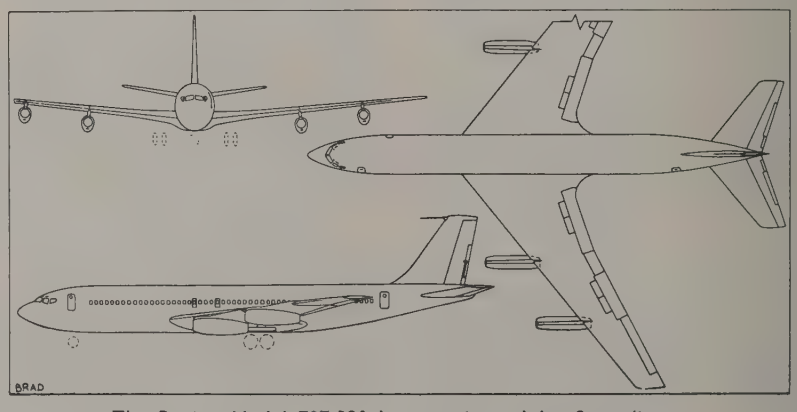
The Model 707 prototype was built as a private venture, primarily as a demonstrator tanker-transport which, in developed form would be able to refuel present and future jet bombers, fighters and reconnaissance aircraft at or near their operational altitudes and speeds.

In August, 1954, it was announced that Boeing had received a production contract from the U.S.A.F. for an advanced tanker-transport version of the 707, to be known as the KC-135 Stratotanker. Substantial additional orders have since been received and it was stated in March, 1957 that over 400 will be built.

On July 13, 1955, Boeing was given clearance by the U.S.A.F. to build a commercial jet aircraft concurrently with the production of military jet tanker-transports, and five types of Stratoliner, the 707-120, 707-220, 707-320, 707-420 and 707-520 have been announced. Up to the time of closing for press a total of 151 of the various versions had been ordered.

The basic versions of the 707 can be identified as follows :—

707-80. The prototype 707 tanker-transport which first flew on July 15, 1954. Fully instrumented for flight-testing and fitted with experimental high-speed Flying Boom aerial fueling equipment. Engine sound-suppressors and thrust reversers have also been installed experimentally. Powered by four Pratt & Whitney JT3C-1 (J57) turbojet engines



The Boeing Model 707-320 Intercontinental Jet Stratoliner

BOEING JET STRATOLINER MODELS.

Model No.	Airline	Quantity ordered	Power-plant	Date of 1st delivery
707-121	Pan American	6	4 x Pratt & Whitney JT3	Late 1958
707-123	American Airlines	30	,, ,, ,,	February 1959
707-124	Continental Air Lines	4	,, ,, ,,	May 1959
707-131	T.W.A.	8	,, ,, ,,	April 1959
707-138	Qantas	7	,, ,, ,,	May 1959
707-139	Cubana	2	,, ,, ,,	March 1960
707-227	Braniff	5	4 x Pratt & Whitney JT4	October 1959
707-321	Pan American	17	,, ,, ,,	—
707-328	Air France	17	,, ,, ,,	November 1959
707-329	Sabena	4	,, ,, ,,	December 1959
707-	VARIG	3	* —	July 1960
707-430	Deutsche Lufthansa	4	4 x Rolls-Royce Conway	January 1960
707-436	B.O.A.C.	15	,, ,, ,,	December 1959
707-437	Air-India International	3	,, ,, ,,	January 1960

* Power-plant not decided at time of writing (30-9-57) but will be either JT4 or Conway.

NOTE : Above table shows orders for 125 aircraft. Total ordered at time of writing was 151 aircraft which included unannounced firm orders or letters of notification for 26 aircraft.

(10,500 lb.=4,765 kg. s.t. each) A.U.W. 190,000 lb. (86,260 kg.). Span : 129 ft. 8 in. (39.5 m.), length : without refuelling boom 119 ft. 6 in. (36.42 m.), with boom 127 ft. 10 in. (38.9 m.), height : 38 ft. 3 in. (11.6 m.).

By mid-March, 1957 a total of 710 flying hours had been logged. In October, 1955, the 707 prototype flew non-stop from Seattle to Washington, D.C. (2,340 miles=3,745 km.) in 3 hours 58 minutes and back to Seattle in 4 hours 8 minutes, representing average speeds of 592 m.p.h. (947 km.h.) and 567 m.p.h. (907 km.h.) respectively. Experimental flying continues, and eventually two Pratt & Whitney J75 turbojets will be fitted to this prototype for flight development, followed later by two Rolls-Royce Conways.

707-120. Basic civil production version intended primarily for continental use but capable of full-load over-ocean operation on many routes. Fuselage length increased to 138 ft. 6 in. (42.24 m.) and width increased by 16 in. (0.41 m.) to 148 in. (3.76 m.). Four Pratt & Whitney JT3C-4 (J57) turbojet engines (12,500 lb. =5,670 kg. s.t. each). Standard accommodation for 124 first class, 124 combined first-class/tourist or 150 tourist passengers. Maximum A.U.W. 248,000 lb. (112,000 kg.).

707-220. Same airframe and accommodation as 707-120 but powered by four Pratt & Whitney JT4A-3 (J75) engines of greater power. Same overall dimensions as 707-120. Maximum A.U.W. 248,000 lb. (112,000 kg.).

707-320 Intercontinental. Enlarged long-range over-water version powered by four Pratt & Whitney JT4A-3 (J75) turbojet engines. Fuselage length increased to 145 ft. 6 in. (44.37 m.). Standard day accommodation for 131 first-class, 124 combined first-class/tourist or 162 tourist passengers. Maximum A.U.W. 296,000 lb. (134,000 kg.).

707-420 Intercontinental. As 707-320 but powered by four Rolls-Royce Conway Mk. 505 turbojet engines.

707-520. Projected version with same basic airframe and accommodation as 707-220, but powered by four Rolls-Royce Conway Mk. 505 turbojets.

KC-135 Stratotanker. Tanker-transport version developed from the 707 prototype as standard aerial tanker for U.S.A.F. Strategic Air Command. In production. First KC-135 flew on August 31, 1956, and the first delivery was made to Castle Air Force Base, Cal., on May 18, 1957.

The following description applies in general to the Model 707 Jet Stratoliner Series :—

TYPE.—Four-engined Jet Airliner.

WINGS.—Swept-wing cantilever monoplane. 35° sweep at 25° of chord. Dihedral 7°. All-metal two-spar structure. Centre-section continuous through fuselage. Two double-slotted flaps on each wing panel. Lateral control at low speeds by normal outboard ailerons and small inboard ailerons, supplemented by two hydraulically-operated spoilers on each wing which are interconnected with the ailerons. Lateral control at high speeds by inboard ailerons and spoilers only. Operation of flaps adjusts linkage between inboard and outboard ailerons to permit outboard operation only with extended flaps. Spoilers may also be used symmetrically as speed brakes. Primary flight controls are manually-operated through spring-tabs. Gross wing area (-120, -220, -520) 2,433 sq. ft. (226 m.^{2}), (-320, -420) 2,908 sq. ft. (270 m.^{2}).

FUSELAGE.—All-metal structure with cross section made up of two circular arcs of different radii, the larger above, faired into smooth-contoured elipse. Maximum external width of fuselage 148 in. (3.76 m.). Maximum external height of fuselage 14 ft. 2½ in. (4.33 m.).

TAIL UNIT.—Cantilever all-metal structure. Anti-balance tab and trim-tab in rudder. Trim and control tabs in each elevator. Electrically and manually operated variable-incidence tailplane. Rudder power-boosted at low speeds on all versions except 707-120. Span of tailplane (-120, -220, -520) 39 ft. 8 in. (12.09 m.), (-320, -420) 51 ft. 8 in. (15.75 m.).

LANDING GEAR.—Retractable tricycle type. Main units are four-wheel bogies which retract inwardly into underside of thickened wing-root and fuselage. Dual nose-wheel unit retracts forward into fuselage. Landing gear doors close when legs fully extended. Gear can be extended in flight to give maximum rate of descent of 15,000 ft./min. (4,570 m./min.). Wheel-base (between centre-lines of shock-struts) (KC-135) 45 ft. 8 in. (13.92 m.), (-120, -220, -520) 52 ft. 4 in. (15.9 m.), (-320, -420) 62 ft. 4 in. (19.1 m.). Track (between centre-lines of shock-struts) 22 ft. 1 in. (6.73 m.).

POWER PLANT.—Four Pratt & Whitney JT3 (-120) or JT4 (-220, -320) turbojet engines or four Rolls-Royce Conway by-pass



The Boeing KC-135A Tanker-Transport (four Pratt & Whitney J57 turbojet engines).



A drawing of the Boeing Model 707-120 Jet Stratoliner (four Pratt & Whitney JT3 turbojet engines).

turbojet engines (-420, -520) in four separate and interchangeable pods, two under each wing. All engines fitted with noise suppressors and thrust reversers. All fuel carried in wings in four interconnected integral interspar compartments accessible through manhole openings in lower wing surfaces. Fuel capacities: (-120, -220, -520) 17,400 U.S. gallons (65,860 litres), (-320, -420) 23,580 U.S. gallons (89,250 litres).

ACCOMMODATION.—Flight compartment seats pilot and co-pilot side-by-side, with stations for flight engineer and navigator behind. Main cabin, free of structural obstructions, can, according to versions and/or customer's requirements, seat from 110 to 162 passengers, five abreast in first class, or six abreast in tourist configurations. Galley, coatroom, and toilets at each end of cabin. Two passenger entrance doors. Baggage compartments, fore and aft of wing, in lower segment of fuselage below cabin floor. As for rest of accommodation, the compartments are pressurised to a differential of 8.6 lb./sq. in. (0.605 kg./cm.^{2}), air-conditioned and temperature controlled. Baggage compartment capacities: forward 700 cub. ft. (19.8 m.^{3}) in -120, -220 and -520, 800 cub. ft. (22.7 m.^{3}) in -320 and -420; aft 900 cub. ft. (25.5 m.^{3}) in all models.

DIMENSIONS (707-120, 707-220 and 707-520).—
Span 130 ft. 10 in. (39.88 m.).
Length overall 144 ft. 6 in. (44.04 m.).
Height (over tail) 38 ft. 7 in. (11.75 m.).

DIMENSIONS (707-320 and 707-420).—
Span 142 ft. 5 in. (43.4 m.).
Length overall 152 ft. 11 in. (45.6 m.).
Height (over tail) 38 ft. 8 in. (11.78 m.).

DIMENSIONS (KC-135).—
Span 130 ft. 10 in. (39.88 m.).
Length overall 136 ft. 3 in. (41.53 m.).
Height 38 ft. 5 in. (11.71 m.).

WEIGHTS (707-120 and -220).—
Max. payload (707-120) 42,700 lb. (19,400 kg.).
Max. payload (707-220) 42,000 lb. (19,000 kg.).
Max. loaded weight 248,000 lb. (112,000 kg.).
Max. landing weight 175,000 lb. (79,000 kg.).

WEIGHTS (707-320 and -420).—
Max. payload 40,000 lb. (18,000 kg.).
Max. loaded weight 296,000 lb. (134,000 kg.).
Max. landing weight 195,000 lb. (88,435 kg.).

WEIGHT (KC-135).—
Weight loaded over 250,000 lb. (113,400 kg.).

PERFORMANCE (707-120).—
Max. cruising speed 591 m.p.h. (950 km.h.).
Take-off field length (I.S.A. at max. A.U.W.) 9,800 ft. (3,000 m.).
Landing distance from 50 ft. (15.25 m.) 6,300 ft. (1,920 m.).
Range with 35,965 lb. (16,315 kg.) payload in still air, with reserves, 3,300 miles (5,310 km.).

PERFORMANCE (707-220).—
Max. cruising speed 605 m.p.h. (972 km.h.).
Take-off field length (I.S.A. at max. A.U.W.) 7,000 ft. (2,135 m.).
Landing distance from 50 ft. (15.25 m.) 6,300 ft. (1,920 m.).
Range with 35,965 lb. (16,315 kg.) payload in still air, with reserves, 3,340 miles (5,375 km.).

PERFORMANCE (707-320).—
Max. cruising speed 605 m.p.h. (972 km.h.).
Take-off field length (I.S.A. at max. A.U.W.) 8,900 ft. (2,715 m.).
Landing distance from 50 ft. (15.25 m.) 6,400 ft. (1,950 m.).
Range with 34,965 lb. (15,860 kg.) payload in still air, with reserves, 4,730 miles (7,612 km.).

PERFORMANCE (707-420).—
Max. cruising speed 595 m.p.h. (956 km.h.).
Take-off field length (I.S.A. at max. A.U.W.) 9,100 ft. (2,775 m.).



The Boeing Model 707-320 Intercontinental Jet Stratoliner (four Pratt & Whitney JT4 turbojet engines).

Landing distance from 50 ft. (15.25 m.) 6,400 ft. (1,950 m.).
Range with 34,965 lb. (15,860 kg.) payload in still air, with reserves, 5,125 miles (8,248 km.).

PERFORMANCE (KC-135).—
Max. speed over 600 m.p.h. (965 km.h.).
Service ceiling over 35,000 ft. (10,670 m.).

THE BOEING MODEL 717.

Announced in July, 1957, the Model 717 will be a short-to-medium range airliner, designed for operation from existing airport runways on stage lengths of from 200 to 1,700 miles (320-2,735 km.). It will be identical in external dimensions to the Model 707-120 and will be built on the same jigs. Major components of the two types will thus be interchangeable, as will the flight deck, manually-operated control system, and all interior furnishings.

The Model 717 will be powered initially by four Pratt & Whitney JT3 (J57) turbojets, but more powerful engines such as the General Electric CJ-805 (J79) turbojet can be used. It will carry a flight crew of three, consisting of pilot, co-pilot and flight engineer, and will have track-mounted seats in its main cabin for 88-130 passengers.

Major weight-saving, to give improved runway performance, has been achieved by lightening the structure to the extent made possible by reducing the fuel load to 10,092 U.S. gallons (38,200 litres). In particular, lighter skin gauges are used in many areas, and lighter-weight landing-gear forgings.

DIMENSIONS.—
Same as for Boeing Model 707-120.

WEIGHTS.—
Weight loaded from 185,000 lb. (83,915 kg.).
Design payload 32,500 lb. (14,742 kg.).
Landing weight 150,000 lb. (68,040 kg.).

PERFORMANCE (estimated).—
Cruising speed at 25,000-40,000 ft. (7,620-12,200 m.) 550-600 m.p.h. (885-965 km.h.).
C.A.R. take-off field length 5,400 ft. (1,645 m.).
C.A.R. landing field length 5,500 ft. (1,675 m.).
Range (max. payload) 1,700 miles (2,735 km.).
Range (full passenger payload) 2,400 miles (3,860 km.).

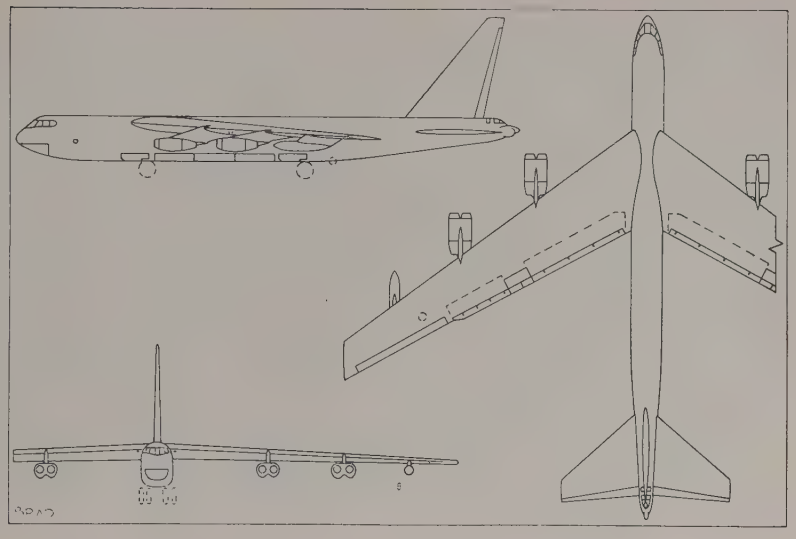
THE BOEING WS-110A.

Boeing are developing under U.S.A.F. contract an advanced type of bomber under the weapons system designation WS-110A. It is reported to be a chemically-fuelled aircraft capable of Mach 3-4.

THE BOEING STRATOFORTRESS.

U.S. Air Force designation: B-52.

The B-52 is an eight-jet swept-wing long-range heavy bomber which is now in quantity production at the Seattle and Wichita plants. The first Seattle-produced B-52A was completed in March, 1954, while the first Wichita-produced Stratofortress, the first B-52D, was completed in December, 1955.



The Boeing B-52A Stratofortress Heavy Bomber.

It was stated in February, 1957 that orders for the B-52 up to that date totalled 502 aircraft and that 101 more were called for under the 1958 fiscal year budget, to provide eventually 11 combat wings, each equipped with 45 of these aircraft. At that time about 150 B-52's had been delivered and production will extend well into 1959.

Although the B-52 is a completely different aircraft from the B-47 insofar as both design and mission are concerned, outwardly the two aeroplanes are somewhat similar in appearance.

Two prototypes, the XB-52 and YB-52, were built, the YB-52 flying for the first time on April 15, 1952, while the XB-52 made its maiden flight on October 2, 1952. During 1957, two pairs of the XB-52's Pratt & Whitney J57 turbojets were each replaced by a single Pratt & Whitney J75 turbojet to accelerate high altitude development of the J-75.

The following production versions of the B-52 have been announced :—

B-52A. First production model, with "cross-wind" landing gear and equipped to receive "flying boom" flight refuelling. First B-52A flew for first time on August 5, 1954. Fitted with two 1,000 U.S. gallon (3,780 litre) drop tanks under outer wings. Gross weight 350,000 lb. (158,900 kg.).

B-52B. Similar to B-52A but capable of undertaking more than one strategic rôle. In addition to bombing (conventional and nuclear) it can also be provided with "capsule" equipment for photographic reconnaissance and other, secret, duties. The "capsule" which may be winched in and out of the bomb-bay, is fully pressurised, air-conditioned and is equipped with stations for a two-man crew. It has provisions for four aerial cameras, interchangeable electronics equipment and antennæ. 30 built.

Three B-52B's of the 93rd Heavy Bomb Wing flew round the world non-stop, a total distance of 24,325 miles (39,147 km.) in 45 hours 19 minutes, on January 16-18, 1957. They were refuelled in flight four times en route.

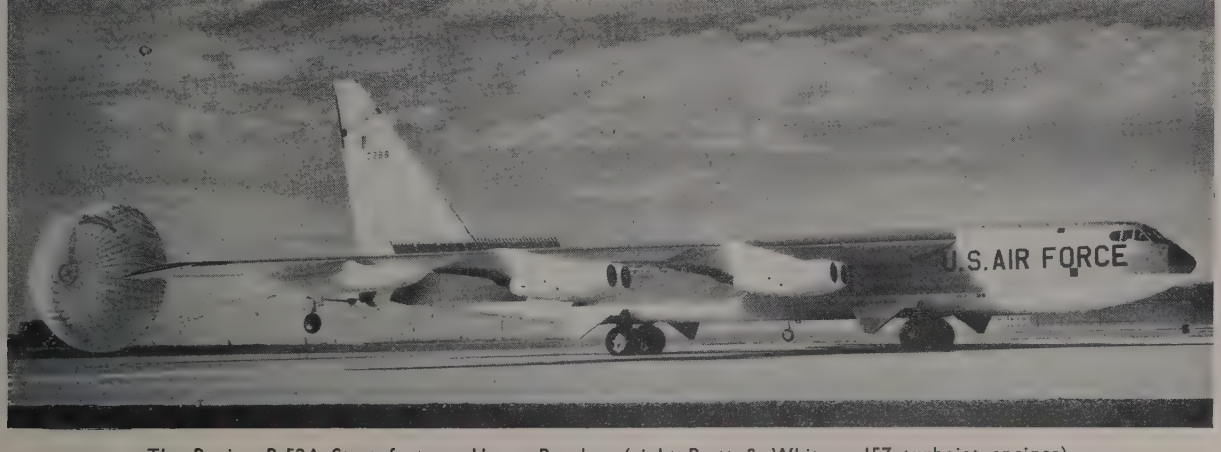
B-52C. Developed version of B-52B with same versatility. Larger underwing drop tanks. All-up weight increased to more than 400,000 lb. (181,600 kg.).

B-52D. Similar to B-52C but is a long-range heavy bomber exclusively. In production at Boeing-Seattle and Boeing-Wichita.

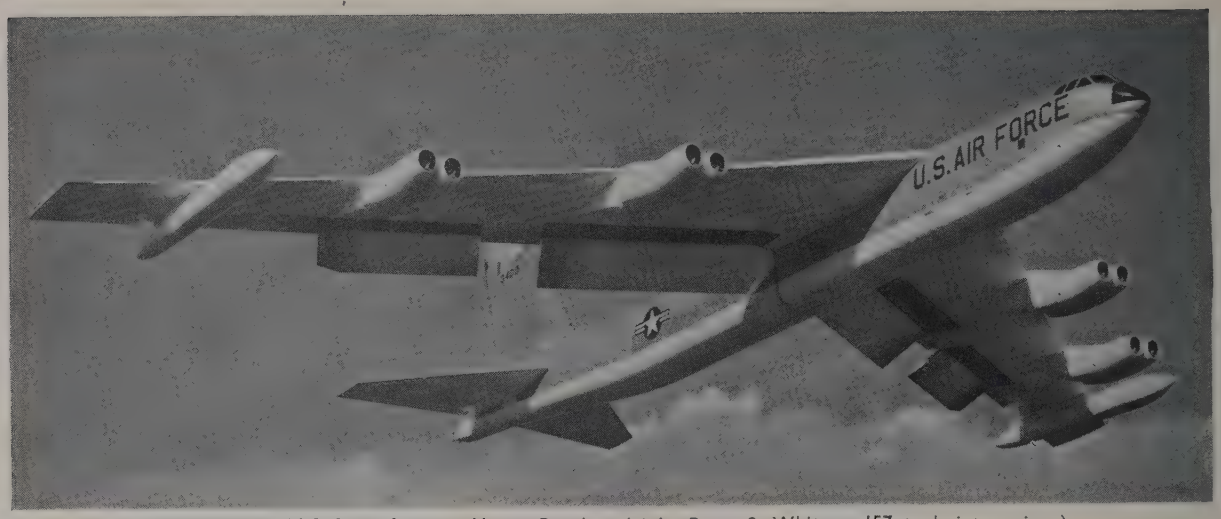
B-52G. Developed version with substantially increased range.

TYPE.—Eight-jet Heavy Bomber.

WINGS.—High-wing cantilever monoplane with anhedral and 35 degree sweepback. All-metal stressed-skin structure. Lateral control by inset ailerons between inner and outer flaps, supplemented by serrated spoilers on upper surface of wings. Spoilers can be used symmetrically as air brakes. Area-increasing flaps. Wing area approximately 4,000 sq. ft. (371.6 m.²).



The Boeing B-52A Stratofortress Heavy Bomber (eight Pratt & Whitney J57 turbojet engines).



The Boeing B-52C Stratofortress Heavy Bomber (eight Pratt & Whitney J57 turbojet engines).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type, with hydraulically-actuated variable-incidence tailplane. All control surfaces operated manually through servo tabs.

LANDING GEAR.—Retractable tandem type. Four individually-retracted twin-wheel main units in tandem pairs, retracting into fuselage fore and aft of bomb-bay. Two forward units with hydraulic steering. All four units can be set at a selected degree of castor in flight or on ground for "cross-wind" landings. Small outrigger units retract inward into wings outboard of outer engine positions. Ribbon braking parachute, 48 ft. (14.6 m.) diameter, in container which extends under rear fuselage.

POWER PLANT.—Eight Pratt & Whitney J57 turbojet engines (on B-52B these are J57-P-19W, each developing 12,100 lb.=5,490 kg. s.t.) in pairs in four nacelles supported on forwardly-inclined cantilever struts under wings. Total fuel capacity approximately 35,000 U.S. gallons (132,485 litres) in wing and fuselage tanks, including two 1,000 U.S. gallon (3,787 litres) jettisonable tanks carried under wing-tips. Single pressure-refuelling point in forward starboard wheel bay. Provision for "flying boom" in-flight refuelling, with inlet on top of fuselage aft of cockpit.

ACCOMMODATION.—Crew of six. Forward pressurised cabin accommodates pilot, co-pilot and radio operator in upward-ejection seats on flight deck, with navigator and radar observer on downward-ejection seats on lower level. Rest bunk, kitchen and toilet on lower deck. Tail gunner has pressurised compartment linked by a crawlway with forward cabin. Crawlway can be used only when cabins de-pressurised. Tail-gunner's compartment is complete with own toilet and electric stove : entire gun and radar installation can be jettisoned for unobstructed exit in emergency. Cabins pressurised to differential of 8.77 lb./sq. in. (0.617 kg./cm.²).

ARMAMENT.—Four 0.50 in. guns in Bosch Arma MD-9 rear turret, with lock-on radar fire-control and periscopic optical sight. Maximum bomb load 75,000 lb. (34,000 kg.). Normal bomb load 25,000 lb. (11,340 kg.) for 3,500 mile (5,630 km.) range.

DIMENSIONS.—
Span 185 ft. (56.42 m.).
Length 156 ft. 6 in. (47.73 m.).
Height over tail 48 ft. 3½ in. (14.73 m.).

WEIGHT.—
Weight loaded over 400,000 lb. (181,600 kg.).

PERFORMANCE.—
Max. speed over 650 m.p.h. (1,040 km.h.).
Service ceiling over 50,000 ft. (15,250 m.).

THE BOEING STRATOJET.
U.S. Air Force designation : B-47.

The XB-47 was the first large jet-propelled aircraft to be fitted with sweptback wings and tail surfaces. Two prototypes were built, the first flying for the first time on December 17, 1947.

The first production order for the B-47 was placed in September, 1948, and the first production B-47A flew on June 25, 1950. Initially production was handled by Boeing-Wichita but in 1951 Douglas and Lockheed were brought into the programme, these two companies being responsible for B-47 production in Government-owned factories at Tulsa, Okla., and Marietta, Ga. respectively.

B-47 production was phased out at Boeing-Wichita in October, 1956 and at Douglas-Tulsa in December, 1956. Production ceased entirely with the acceptance of the final B-47E from Lockheed-Marietta on February 15, 1957.

Altogether, over 1,400 B-47's were delivered to the U.S.A.F. Strategic Air Command by Boeing alone. As later types become available, it is planned to transfer B-47's to the Tactical Air Command.

The B-47 is claimed to be the first aircraft of its size capable of "toss-bombing," a technique for low-altitude delivery of tactical nuclear weapons in which the aircraft pulls up vertically, releases its bomb and rolls out on top of a half-loop. The weapon describes a high arc, falling on the target a great distance from the point of release, while the aircraft speeds away in the opposite direction.

XB-47. Two prototypes, both originally fitted with General Electric J35 engines (4,000 lb.=1,816 kg.). In 1949 first prototype re-engined with J47 engines (5,200 lb.=2,360 kg. s.t.). Re-engined XB-47 flew for first time on October 7, 1949.

B-47A. Six General Electric J47-GE-11 engines (5,200 lb.=2,360 kg. s.t.). 18 individual Jato solid-fuel rockets fitted to give emergency take-off thrust of 20,000 lb. (9,080 kg.). First production B-47A flew for the first time on June 25, 1950.

B-47B. Six General Electric J47-GE-23 engines (5,800 lb.=2,630 kg. s.t.). Gross weight 185,000 lb. (84,000 kg.). Fitted with wing drop tanks. First B-47B flew on April 26, 1951. B-47B's have been modified and modernised up to B-47E standard by Boeing-Wichita. Modifications include installation J47-GE-25 engines and water-injection system to give 17% increased T.O. power ; substitution of droppable 33-rocket T.O. assist for original internal 18-rocket equipment ; installation of 16-foot approach parachutes ; installation of ejection seats (pilot and co-pilot up, navigator down) ; re-arrangement of equipment in flight compartment and substitution of G.E. radar-directed tail gun-turret armed with two 20 mm. cannon for former .50-cal. guns. Modernisation programme, which began late in 1954, was under way for eighteen months. Modified B-47B's are known as B-47B II.



The Boeing B-47B II Stratojet Medium Bomber (six General Electric J47 turbojet engines). (*Gordon Williams*).



The Boeing B-47E Stratojet Medium Bomber (six General Electric J47 turbojet engines). (*Gordon Williams*).

KB-47B. Experimental tanker modification of B-47B. Used an adaptation of Flight Refuelling "probe-and-drogue" system installed in bomb-bay. Now reverted to B-47B configuration.

RB-47B. Conversion of B-47B for high-altitude photographic reconnaissance. Eight cameras and equipment in heated "package" can be installed in and removed from bomb-bay.

XB-47C. Research aircraft which was to have been fitted with four Allison J71 engines. Project cancelled.

XB-47D. Two B-47B's modified to serve as test-beds for the Wright T49 turboprop engine. Two T49 engines are installed in place of the two pairs of J47 turbojets in the inboard pod positions. First XB-47D flew on August 26, 1955. Programme now cancelled.

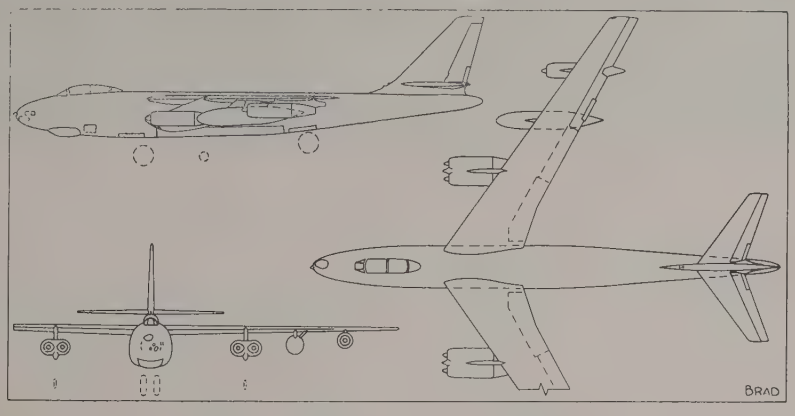
B-47E. Six General Electric J47-GE-25 engines (6,000 lb.=2,724 kg. s.t.). Developed version of B-47B. Remotely-controlled tail armament of two 20 mm. cannon. First B-47E flew on January 30, 1953. The 1,000th Stratojet, a B-47E, was delivered to the U.S.A.F. on December 17, 1954.

RB-47E. Day or night long-range photographic reconnaissance version of B-47E. Longer nose. Heated and air-conditioned camera compartment. Crew of three, pilot, co-pilot and photographer-navigator. First RB-47E flew on July 3, 1953. Length 109 ft. 10 in. (33.5 m.), other dimensions as for B-47E. Last RB-47E delivered to U.S.A.F. on August 3, 1955.

RB-47K. Similar to RB-47E but equipped for both photographic and weather reconnaissance.

DB-47. When modified to carry a Bell GAM-63 Rascal "stand-off" powered bomb on a special rack mounted externally on the starboard side of their fuselages, B-47's are redesignated as DB-47's.

One B-47 has been loaned to the Canadian Orenda company as a flying test bed for the Iroquois turbojet, which is installed in a nacelle on the starboard side of the rear fuselage. It was modified for the purpose by Canadair and is designated the Canadair CL-52.



The Boeing B-47E Stratojet Medium Bomber.

The description which follows refers to the B-47E.

TYPE.—Six-jet Medium Bomber.

WINGS.—Shoulder-wing cantilever monoplane with anhedral and 35 degree sweepback. Thin laminar-flow wing section. All-metal stressed-skin structure.

FUSELAGE.—Oval-section all-metal structure with flush-riveted stressed-skin covering.

TAIL UNIT.—Cantilever monoplane type. All-surfaces swept-back. All-metal structure.

LANDING GEAR.—Retractable tandem type. Two main twin-wheel units in tandem retracting forward into fuselage fore and aft of bomb-bay. Small outrigger wheel units retract into inboard engine nacelles.

POWER PLANT.—Six General Electric J47 turbojet engines, four paired in two nacelles supported on forwardly-inclined cantilever struts under inner wings and two in single nacelles under outer wings near tips. Auxiliary take-off power provided by rocket motors on a collar type rack mounted beneath the fuselage. Thirty-three JATO units of 1,000 lb. (454 kg.) thrust each can be carried. Rack can be dropped after rocket power is expended. Water injection systems are fitted to engines in B-47E and RB-47E and are being installed in modernised B-47B's. All production B-47's have provision for flight re-fuelling, using Boeing "Flying Boom" system.

ACCOMMODATION.—Crew of three. Pilot and co-pilot in tandem under bubble-type canopy. Bombardier in nose. Ejection seats for all crew members, pilot and co-pilot ejected upwards and navigator downward under nose. Entire crew accommodation forward of wings pressurised and temperature-controlled.

ARMAMENT.—Remotely-controlled tail armament only. Consists of two 20 mm. cannon. No other details available. Designed internal bomb load 20,000 lb. (9,080 kg.).

DIMENSIONS.—
Span 116 ft. (35.4 m.).
Length 107 ft. (32.6 m.).
Height (over tail) 28 ft. (8.5 m.).

DESIGNED LOADED WEIGHT.—
200,000 lb. (90,800 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.).
Range (internal fuel) over 3,000 miles (4,830 km.).

THE BOEING STRATOCRUISER.

Stratocruisers are being operated by Pan American World Airways (26), Northwest Airlines (9) and British Overseas Airways (16).

Pan American World Airways have modified their fleet of Stratocruisers to obtain increased performance. The engines of all the 26 aircraft have been fitted with G.E. CH-10 turbo-superchargers, the slightly larger turbine wheels of which will permit the engines to develop another 50 h.p. each. Ten of



The Boeing RB-47E Photographic Reconnaissance Aircraft (six General Electric J47 turbojet engines). (*Gordon Williams*).



A Boeing Stratocruiser (four 3,500 h.p. Pratt & Whitney R-4360 Wasp-Major engines) in B.O.A.C. colours.

these aircraft, operated by the company's Atlantic Division, have also been given increased fuel capacity in the outer wings to provide non-stop New York-London (or Paris) range, and are known by Pan American as "Super Stratocruisers." The remaining aircraft, operated by the Pacific-Alaska Division, do not need the increased range.

On April 1, 1956, statistics showed that Stratocruisers had, since going into service in 1946, flown a total of 205,328,000 miles in 818,000 hours. They had made 18,400 Atlantic crossings and 15,500 Pacific crossings and had carried more than 4,180,000 passengers. Several individual aircraft had by that time flown more than 5 million miles in scheduled service.

TYPE.—Four-engined Airliner.

WINGS.—Low-mid-wing cantilever monoplane. Boeing 117 aerofoil section. Aspect ratio 11.58. All-metal two-spar stressed-skin structure. Electrically-operated Fowler-type flaps. Built-in thermal anti-icing system. Gross wing area 1,769 sq. ft. (164.2 m.²).

FUSELAGE.—All-metal semi-monocoque structure of inverted figure-8 cross-section designed for pressurization. Max. width of fuselage 11 ft. (3.35 m.). Max. depth 15 ft. 2½ in. (4.65 m.). Ground clearance 1 ft. 10½ in. (0.55 m.).

TAIL UNIT.—Cantilever monoplane type. Fixed surfaces of two-spar stressed-skin construction with built-in thermal anti-icing system. Rear portion of fin and the rudder are hinged to fold sideways for hangar stowage or servicing, the overall height over fin being so reduced by 12 ft. (3.6 m.). Movable surfaces have metal frames and fabric covering and are aerodynamically and mass-balanced. Trim-tabs in elevators and rudder. Hydraulically-operated power-boost system for rudder control. Tailplane span 43 ft. (13.1 m.).

LANDING GEAR.—Retractable tricycle type. All three units with dual wheels, main wheels 4 ft. 8 in. (1.42 m.) diameter, nose-wheels 3 ft. (0.915 m.) diameter. Electric retraction with emergency manual operation. Pedal-operated service brakes and hand-operated emergency brakes operated by separate hydraulic systems. Wheel track 28 ft. 5.6 in. (8.62 m.). Wheel base 36 ft. 1.16 in. (11 m.). Min. turning radius (approx.) 29 ft. (8.85 m.). Fuselage static position 2° nose-up.

POWER PLANT.—Four Pratt & Whitney R-4360 Wasp-Major twenty-eight-cylinder four-row radial air-cooled geared and turbo-supercharged engines each developing a maximum output of 2,800 h.p. and with a take-off output of 3,500 h.p. with water-injection. Curtiss Electric or Hamilton Standard four-blade constant-speed full-feathering and braking airscrews 16 ft. 8 in. (5 m.) in diameter. All four engine nacelles quickly detachable and interchangeable. Five groups of seven nylon bladder-type fuel cells in wings, with total capacity of 7,790 U.S. gallons (29,450 litres). Pan American "Super Stratocruisers" have an additional 410 U.S. gallons (1,550 litres) in cells in outboard wing sections.

ACCOMMODATION.—Two-deck fuselage, the upper deck accommodating the control cabin and the main passenger compartment and the lower deck a passenger lounge and two cargo holds. Control cabin in nose seats two pilots side-by-side with dual controls, navigator, engineer and radio operator. Various arrangements and furnishings of main upper deck passenger compartment permit seating for from 55 to 100 passengers. Standard arrangement accommodates a total of 81 passengers, 67 in main compartment and 14 in lower deck lounge. Circular stairway interconnects the two compartments. Main cabin entrance on port-side aft on upper deck level. Lower rear cargo door with built-in steps may be used to give access to main cabin *via* lounge stairway. In a sleeper version main cabin may be fitted with 28 upper and lower berths plus 5 seats. in addition to 14 seats in lounge. Fully-equipped galley with electric ovens, refrigerators, cupboard space and vacuum containers for hot or cold foods and liquids. Men's and ladies' dressing rooms and toilets. Lower-deck fore and aft cargo compartment doors have sills at truck-level height. Capacity of compartments: control cabin 472 cub. ft. (13.2 m.³), main upper deck passenger compartment 4,041 cub. ft. (113.2 m.³), lower passenger lounge 500 cub. ft. (14.15 m.³), ladies' dressing room 228 cub. ft. (6.38 m.³), men's dressing room 238 cub. ft. (6.66 m.³), galley 350 cub. ft. (9.8 m.³), forward cargo hold 520 cub. ft. (14.56 m.³), rear cargo hold 325 cub. ft. (9.1 m.³). Heights of fuselage doors: main entrance door 9 ft. 10 in. (3 m.) forward cargo hold door 4 ft. 11 in. (1.5 m.), rear cargo hold door 4 ft. 5 in. (1.34 m.). Width of main cabin (inside linings) 10 ft. 4½ in. (3.16 m.). Complete automatic air-conditioning equipment with pressurization permitting operation at 15,000 ft. (4,575 m.) with sea-level cabin atmosphere and at 25,000 ft. (7,625 m.) with equivalent cabin pressure of 5,500 ft. (1,680 m.), combined radiant and convection heating, cabin cooling and ground air-conditioning with self-contained power supply.

DIMENSIONS.—
Span 141 ft. 3 in. (43 m.).
Length 110 ft. 4 in. (33.65 m.).
Height 38 ft. 3 in. (11.66 m.).
Height (with fin and rudder folded) 26 ft. 7 in. (8.11 m.).

WEIGHTS AND LOADINGS.—
Weight empty 83,500 lb. (37,910 kg.).
Designed disposable load 59,000 lb. (26,786 kg.).
Designed normal take-off weight 145,800 lb. (76,195 kg.).
Landing weight 121,700 lb. (55,252 kg.).
Wing loading 80.5 lb./sq. ft. (392.8 kg./m.²).
Power loading 10.2 lb./h.p. (4.63 kg./h.p.).

PERFORMANCE.—
Max. speed 375 m.p.h. (603 km.h.) at 25,000 ft. (7,625 m.).
Max. cruising speed (1,900 h.p. per engine) 340 m.p.h. (544 km.h.) at 25,000 ft. (7,625 m.).
Landing speed 93 m.p.h. (150 km.h.).
Rate of climb at sea level 1,100 ft./min. (335 m./min.).
Rate of climb on three engines 500 ft./min. (152 m./min.).
Service ceiling over 32,000 ft. (9,760 m.).
Three-engine ceiling 21,000 ft. (8,540 m.).
Take-off run to clear 50 ft. (15.25 m.) (at 135,000 lb.=61,290 kg. take-off weight) 1,800 yds. (1,647 m.).
Landing run from 50 ft. (15.25 m.) (at 105,000 lb.=47,520 kg. landing weight) 1,880 yds. (1,720 m.).
Landing run from 50 ft. (15.25 m.) with reverse thrust on two engines 1,610 yds. (1,473 m.).
Range (max. fuel) 4,600 miles (7,360 km.).

THE BOEING STRATOFREIGHTER.

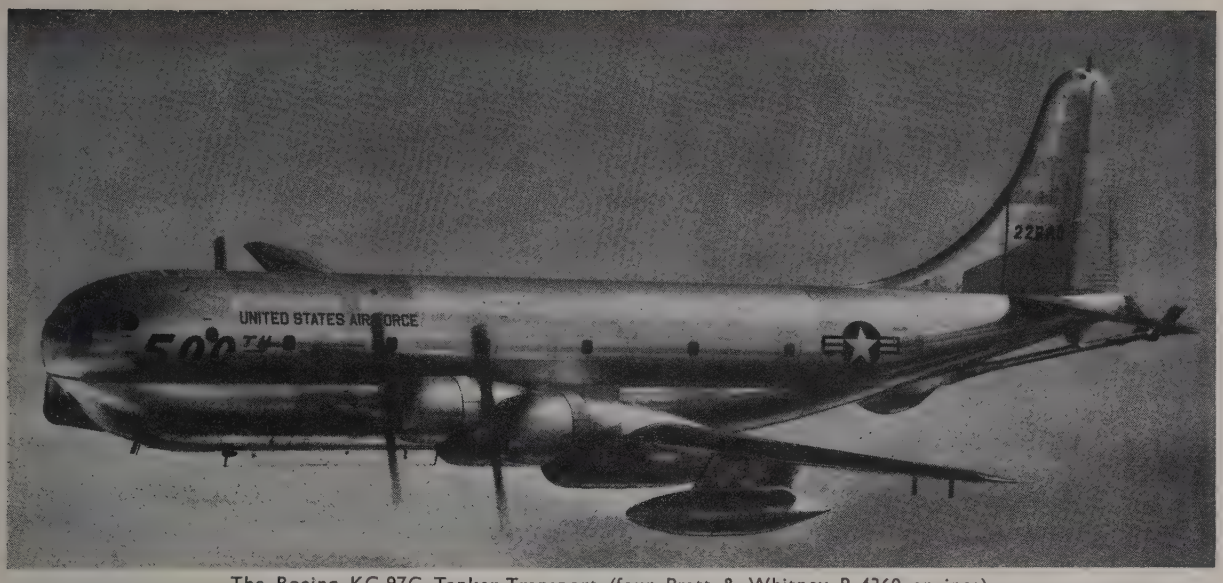
U.S. Air Force designation: C-97.

The C-97 Stratofreighter is the military transport counterpart of the Stratocruiser, from which it differs principally in the arrangement and equipment of the large two-deck fuselage. The XC-97 was, in fact, the forerunner of the civil Stratocruiser and all initial prototype trials of the civil airliner were conducted with the XC-97.

The principal structural modification to the C-97 fuselage involves the provision of large loading doors and an internally operated ramp under the rear fuselage to permit the loading of wheeled and tracked vehicles and other bulky cargo. An electrically-operated cargo hoist runs along the entire length of the fuselage. Three fully-loaded 1½-ton trucks or two light tanks can be driven into the fuselage, the drive-up ramp being raised and lowered by the cargo hoist. Adequate cargo handling and tie-down equipment is provided. The cabins can also be arranged to accommodate 134 fully-equipped troops, or be fitted out as a hospital transport for 83 stretcher cases and four attendants.

Three XC-97's were built and these were followed by ten YC-97's in three different versions of the basic design. These prototype and service test aircraft incorporated the wings, tail-unit, landing-gear and power-plant of the B-29. The C-97A and subsequent production versions use the main components of the B-50.

The 500th Stratofreighter—a KC-97G—was completed on February 8, 1954. The 888th and last KC-97 was wheeled out of the Renton plant on July 18, 1956, the same day on which the first jet-powered KC-135 emerged from the factory. The completion of the last KC-97 marked the end of Boeing's production of piston-engined aircraft.



The Boeing KC-97G Tanker-Transport (four Pratt & Whitney R-4360 engines).

The principal features of the many versions of the C-97 are given below.

C-97A. Four Pratt & Whitney R-4360-27 engines. First production aircraft delivered to U.S.A.F. on October 15, 1949. C-97A has a normal payload of 41,400 lb. (18,800 kg.) and under special conditions can carry up to 53,000 lb. (24,060 kg.). It can accommodate 134 fully-equipped troops or mixed loads of cargo or troops. As an ambulance it can transport 83 stretcher patients with medical supplies and attendants.

C-97C. Four 3,250 h.p. Pratt & Whitney R-4360-35A engines. Similar to C-97A in general details and performance. New flush-mounted radio antennae, heavier floor, higher payload. First production C-97C delivered to U.S.A.F. in February, 1951.

VC-97D. Three specially-modified C-97A's supplied to U.S.A.F. Strategic Air Command as mobile "command posts." Used as Staff Transports and living quarters for key personnel in overseas training missions.

KC-97E. Four 3,250 h.p. Pratt & Whitney R-4360-35A engines. Multi-purpose transport and tanker. Has permanent fixtures for tanker but can be rapidly converted to cargo or troop carrier, or ambulance. "Pod" carrying "Flying Boom," operator and controls is detachable and tanks, pumps, etc. on upper deck are removable. First production KC-97E delivered to U.S.A.F. in July, 1951.

KC-97F. Four 3,250 h.p. Pratt & Whitney R-4360-59 engines. Convertible tanker-transport. Other details and performance similar to KC-97E.

KC-97G. Four 3,250 h.p. Pratt & Whitney R-4360-59B engines. Development of KC-97F. Change in location of refuelling tanks and related equipment, so that they need not be removed when aircraft is used as a transport. As a personnel carrier without refuelling equipment can carry 96 fully equipped combat troops, or as an ambulance, 69 stretcher patients, medical attendants and supplies. With refuelling equipment installed can carry 65 fully-equipped troops or 49 stretcher cases, attendants and supplies. Fitted with two external fuel tanks with total capacity for 1,400 U.S. gallons (5,290 litres). Pressurisation system maintains ground atmospheric pressure to 15,500 ft. (4,730 m.).

YC-97J. Two C-97's fitted with four 5,700 h.p. Pratt & Whitney YT34 turbo-prop engines for development trials with this type of power-plant. Gross weight 175,000 lb. (79,450 kg.). First YC-97J made its maiden flight on April 19, 1955.

The particulars below refer specifically to the KC-97G.

DIMENSIONS.—
Span 141 ft. 3 in. (43.1 m.).
Length 110 ft. 4 in. (33.64 m.).
Height 38 ft. 3 in. (11.6 m.).

WEIGHTS.—
Weight empty 82,500 lb. (37,450 kg.).
Weight loaded 153,000 lb. (69,460 kg.).
Max. permissible loaded weight 175,000 lb. (79,450 kg.).
Landing weight 121,000 lb. (54,930 kg.).

PERFORMANCE.—
Max. speed 375 m.p.h. (600 km.h.).
Cruising speed 300 m.p.h. (480 km.h.).
Operating range 4,300 miles (6,880 km.).
Service ceiling over 35,000 ft. (10,675 m.).

THE BOEING BOMARC.

U.S.A.F. designation: IM-99.

Following a programme of test firings with 112 GAPA (Ground to Air Pilotless Aircraft) rockets in 1946-49, Boeing began work on a new pilotless interceptor missile in collaboration with scientists at the University of Michigan. Known originally as the F-99 Bomarc (Bo for Boeing, marc for Michigan Aeronautical Research Center), this weapon has since been redesignated the IM-99 and first photographs of it were issued in May, 1957.

Designed to intercept high-flying supersonic aircraft at long distances from its firing point, Bomarc has a conventional aircraft-type configuration and is powered by two Marquardt ramjets. An Aerojet liquid-propellant rocket in its fuselage accelerates it initially to the speed at which the ramjets can take over. Further specification details are given in the "Guided Missiles" section of this work.

The first test firing in the Bomarc programme was made in the autumn of 1952 and since then a number of XIM-99 missiles have been fired successfully against target drones from Patrick A.F.B., Florida. Subsequent tests are scheduled with a service test batch of YIM-99 Bomarcs, and the U.S.A.F. announced a production order for the weapon on May 16, 1957. Many of the structural components will be built at Boeing-Wichita; but 70% of the complete weapons system will be sub-contracted to other companies, and final assembly will be at Boeing-Seattle.

BRANTLY

BRANTLY HELICOPTER CORPORATION.

HEAD OFFICE: 24 MAPLEWOOD AVE., PHILADELPHIA 44, PENNSYLVANIA.

WORKS: MUNICIPAL AIRPORT, FREDERICK, OKLAHOMA.

President: N. O. Brantly.
Secretary-Treasurer: E. K. Dawes.
General Manager: A. P. Hoover.

Brantly Helicopter Corporation was formed by Mr. N. O. Brantly, who designed a helicopter with co-axial rotors, known as the Model B-1, in 1943. This aircraft flew in 1946, but was too complex for a personal type helicopter.

Mr. Brantly then designed the Model B-2, using the rotor design from the B-1 which is distinctive in having coincident flapping and lag hinges at approximately 40% of the blade length. A second flapping hinge was added near the hub, to make the rotor suitable for a single-rotor configuration.



The Brantly Model B-2 Helicopter (Lycoming VO-340 engine).

The prototype of the Brantly B-2 first flew on February 21, 1953 and had completed 130 hours' flying by the autumn of 1956. A second prototype, incorporating various improvements, first flew on August 14, 1956, and is described in detail below.

The second B-2 was scheduled to undertake its C.A.A. certification tests during 1957, and the company has started work on 15 production models, the first of which is due off the assembly line in January, 1958.

THE BRANTLY MODEL B-2.

TYPE.—Two-seat Light helicopter.

ROTOR SYSTEM.—Three-blade main rotor of all-metal construction, with articulated inboard flapping hinges offset 2.67 in. (67.8 mm.) from hub, and coincident flap and lag hinges offset 51.85 in. (1,317 mm.) from hub. Symmetrical blade section with 29% thickness ratio on inboard portion: NACA 0012 section outboard of hinge. Chord 8.84 in. (22.45 cm.) inboard portion: 8 in. (20.32 cm.) outboard portion. Blades attached to hub by flapping links. Conventional hub. Area of each main rotor blade 7.34 sq. ft. (0.68 m.²). Main rotor disc area 442 sq. ft. (41.06 m.²). Two-blade tail anti-torque rotor of all-metal construction. Disc area of tail rotor 13.5 sq. ft. (1.25 m.²).

ROTOR DRIVE.—Through centrifugal clutch and planetary reduction gears. Bevel gear take-off from main transmission with flexible coupling to tail rotor drive shaft. Main rotor/engine r.p.m. ratio 1 : 6.5. Anti-torque rotor/engine r.p.m. ratio 1 : 1.

FUSELAGE.—Stressed skin all-metal structure with conical tail section. Tail rotor now on swept-up boom extension.

LANDING GEAR.—Interchangeable wheels and skids. Fixed tail-skid. Oleo shock-absorbers with rubber disc taxying springs. Goodrich wheels 5 in. (12.7 cm.) diameter. Tyres 5.00 × 4, pressure 30 lb./sq. in. (2.11 kg./cm.²). Wheel track 6 ft. 5 in. (1.98 m.). Wheelbase 13 ft. 7½ in. (4.14 m.).

POWER PLANT.—One 162 h.p. Lycoming VO-340 A1A four-cylinder, horizontally-opposed air-cooled engine, mounted vertically, with induction cooling system. Fuel tank under engine, capacity 22.5 U.S. gallons (85 litres). Oil capacity 2 U.S. gallons (8.55 litres).

ACCOMMODATION.—Totally-enclosed cabin for two persons seated side-by-side. Doors are hinged on centre-line of cabin and open upwards. Dual controls. Compartment for 50 lb. (22.7 kg.) baggage in forward end of tail section.

DIMENSIONS.—
Diameter of main rotor 23 ft. 8¼ in. (7.22 m.).
Diameter of tail rotor 4 ft. 3 in. (1.29 m.).
Length 22 ft. 8 in. (6.90 m.).
Overall width 6 ft. 5 in. (1.96 m.).
Height 6 ft. 10 in. (2.08 m.).

WEIGHTS.—
Weight empty 938 lb. (425 kg.).
Weight loaded 1,550 lb. (703 kg.).

PERFORMANCE (approx.).—
Max. speed over 120 m.p.h. (193 km.h.).
Cruising speed 100 m.p.h. (161 km.h.).
Rate of climb at S/L. over 1,000 ft./min. (305 m./min.).
Rate of autorotative descent at S/L. 1,400 ft./min. (425 m./min.).

CALLAIR

THE CALL AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: AFTON, WYOMING.

Manager: Barlow H. Call.

The original CallAir Model A two-seat light cabin monoplane was flown in 1941 and put into production two years later. The latest development of this type is the A-4, the agricultural version of which is being produced at the rate of one aircraft per week.

THE CALLAIR A-4 AG.

The CallAir A-4 Ag. aircraft has simplified structure and specialised equipment for agricultural duties.

Its two-seat open or enclosed cockpit is on the port side, with the dust hopper adjacent on the starboard side. Standard equipment includes a simplified instrument panel, turnover structure, B-11 safety belt and shoulder harness.

There are four versions of the A-4 Ag., as follows:—

Standard A-4. Fiberglass dust hopper only, capacity 18 cub. ft. (0.51 m.³).

A-4 Duster. As standard A-4, with addition of spreader and hopper throat and door actuating mechanism.

A-4 Sprayer. As standard A-4, with addition of spray equipment, comprising Simplex wind-driven pump and booms constructed of ⅞ in. (2.21 cm.) tubing with provision for mounting up to 48 Teejet nozzles. Simplex dump valve able to release 100 U.S. gallons (378 litres) of liquid in about 3 seconds.

A-4 Combination. As standard A-4, with both dust and spray dispensing gear.



The CallAir A-4 Duster-Sprayer (150 h.p. Lycoming O-320 engine).

TYPE.—Two-seat Agricultural aircraft.

WINGS.—Braced low-wing monoplane. High-lift wing section. Constant-chord structure with wooden spars and ribs, metal-covered leading-edge and fabric covering aft. Multiple steel-tube bracing struts on each side of fuselage. Ailerons of wooden construction with fabric covering. End-plates at tips.

FUSELAGE.—Steel-tube structure with fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Steel-tube framework with fabric covering.

LANDING GEAR.—Fixed tail-wheel type. Main wheels carried on braced V structures with oleo shock-absorbers attached to front wing spar. Fully-castoring steerable tail-wheel has leaf-spring shock-absorber. Oversize tyres. Goodyear disc brakes.

POWER PLANT.—One 150 h.p. Lycoming O-320-A2A four-cylinder horizontally-opposed air-cooled engine. Sensenich two-blade fixed-pitch metal airscrew.

ACCOMMODATION.—Open or enclosed tandem two-seat cabin on port side of fuselage, with hinged access door. Steel-tube turnover structure from engine bulkhead over entire cabin top. B-11 safety belts and shoulder harness.

DIMENSIONS.—
Span 33 ft. 6 in. (10.21 m.).
Length 23 ft. 5⅝ in. (7.15 m.).
Height 7 ft. (2.13 m.).

WEIGHTS AND LOADINGS.—
Weight empty 975 lb. (442 kg.).
Disposable load 1,175 lb. (533 kg.).
Weight loaded 2,150 lb. (975 kg.).
Wing loading 11.94 lb./sq. ft. (58.3 kg./m.²).
Power loading 14.3 lb./h.p. (6.49 kg./h.p.).

PERFORMANCE.—
Cruising speed (75% power) 100 m.p.h. (161 km.h.).
Landing speed 43 m.p.h. (69 km.h.).
Rate of climb at S/L. 500 ft./min. (153 m./min.).
Service ceiling 17,000 ft. (5,180 m.).
Take-off distance 750 ft. (230 m.).
Landing distance 400 ft. (122 m.).
Range 350 miles (563 km.).

CARMA

CARMA MANUFACTURING COMPANY.

HEAD OFFICE AND WORKS: 1,879 MULLIN AVENUE, TORRANCE, CALIFORNIA.

AIRCRAFT DIVISION: TUCSON, ARIZONA.

The Carma Manufacturing Company was established in 1948 to produce electrical and mechanical equipment and controls for aircraft.

An aircraft division was formed at Tucson, Arizona, in 1954 to manufacture the Weejet jet-trainer, a description of which follows.

THE CARMA WEEJET VT-1.

The Weejet was designed to C.A.A. trainer requirements and the prototype flew for the first time on March 30, 1956. It was later destroyed in a flying accident, but further Weejets were expected to be built during 1957, incorporating minor changes. The following details apply to the developed version.



The Carma Weejet VT-1 Primary Trainer (Continental J69 turbojet engine).

TYPE.—Two-seat jet Primary Trainer.

WINGS.—Mid-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 5.22. Mean chord 5 ft. 6 in. (1.68 m.). Incidence 2°. Aluminium alloy structure. All-metal ailerons and slotted flaps. Wing area 150 sq. ft. (13.94 m.²).

FUSELAGE.—Aluminium alloy semi-monocoque structure.

TAIL UNIT.—"Butterfly" type consisting of tailplane and elevators set at acute dihedral angle. Aluminium alloy structure. Total area of tail surfaces 45.5 sq. ft. (4.23 m.²).

LANDING GEAR.—Retractable tricycle type. Carma hydraulic shock-absorber struts. Electrical retraction. Goodyear wheels, tyres and brakes. Wheel track 10 ft. 2 in. (3.10 m.). Wheel base 8 ft. 8 in. (2.64 m.).

POWER PLANT.—One Continental J69-T-9 turbojet engine supplying 920 lb. (417 kg.) s.t. at sea level. Fuel in two wing tanks with total capacity of 132 U.S. gallons (500 litres). Two auxiliary wing-tip tanks

with total capacity of 100 U.S. gallons (378.5 litres) can be carried for ferrying. Oil capacity 2 U.S. gallons (7.5 litres).

ACCOMMODATION.—Pupil and instructor side-by-side in enclosed cabin. The two main transparent panels hinge upwards along the centre-line to give access to the cockpit. AN/ARC-27 command radio and AN/ARA-25 direction finder radio.

DIMENSIONS.—
Span 28 ft. (8.53 m.).
Length 24 ft. 6 in. (7.47 m.).
Height 6 ft. 8 in. (2.03 m.).

WEIGHTS AND LOADINGS.—
Weight empty 2,481 lb. (1,125 kg.).
Normal weight loaded 3,826 lb. (1,735 kg.).
Max. weight loaded 4,541 lb. (2,060 kg.).
Wing loading (normal) 25.5 lb./sq. ft. (124.5 kg./m.²).

PERFORMANCE (at 3,826 lb. = 1,735 kg.).—
Max. speed at 15,000 ft. (4,570 m.) 334 m.p.h. (537 km.h.).
Cruising speed at 15,000 ft. (4,570 m.) 283 m.p.h. (456 km.h.).
Stalling speed at landing weight 64.5 m.p.h. (104 km.h.).
Rate of climb at S/L. 2,200 ft./min. (670 m./min.).
Time to 20,000 ft. (6,100 m.) 11.1 min.
Service ceiling 35,000 ft. (10,670 m.).
Take-off to 50 ft. (15.25 m.) 1,800 ft. (550 m.).
Endurance at S/L. 1.72 hr.

CESSNA

THE CESSNA AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: WICHITA, KANSAS.

Established: September 22, 1927.

President and General Manager: Dwane L. Wallace.

Vice-President and Treasurer: Frank A. Boettger.

Vice-President Engineering: Tom Salter.

Vice-President, Manufacturing: Del Roskam.

Secretary and Controller: Raymond G. Largent.

The Cessna Aircraft Company was founded by the late Clyde V. Cessna, a pioneer in U.S. aviation since 1911, and was incorporated in 1927. It marked its 30th anniversary in 1957 with the roll-out of its 30,000th aircraft.

The Company now has in production four commercial aircraft for civilian use, including the Model 172, introduced late in 1955; Model 180, introduced in 1953; Model 182, introduced early in 1956; and the twin-engined Model 310, which went into production late in 1954. A fifth, the Model 620 executive aircraft, is scheduled to go into production early in 1958.

Cessna is also producing the T-37A twin-engined jet trainer for the U.S.A.F.; the TL-19D instrument trainer for the U.S. Army; and the YH-41 helicopter, of which the U.S. Army has ordered an evaluation quantity. A licensing agreement signed in 1957 will allow Fuji Heavy Industries of Tokyo to manufacture the L-19 also in Japan.

Sub-contract work undertaken by Cessna includes production of tailplanes for the B-52 Stratofortress for both the Boeing Wichita and Boeing Seattle divisions, and of assemblies for the Lockheed T-33 and T2V-1 and Republic F-84F.

To accommodate large-scale production of the T-37A trainer and Model 620, Cessna has under construction a large new factory at Wichita, which will be known as the Wallace Plant. It is scheduled for completion in 1960.

The company also has an industrial hydraulics division located at Hutchinson, Kansas which is a specialized division engaged primarily in the manufacture of industrial and agricultural hydraulic cylinders and components.



The Cessna Model 620 (four 340 h.p. Continental GSO-526 engines).

THE CESSNA MODEL 620.

The Model 620 is a four-engined fully-pressurised aircraft with accommodation for up to 11 passengers and designed specifically for business and corporate use. It can be adapted easily into a light cargo transport or mixed passenger/freighter and complies with the CAR4-b transport category requirements.

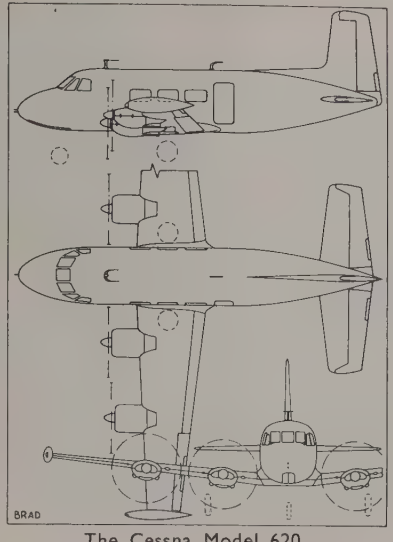
The prototype of the Model 620 made its first flight on August 11, 1956 and the type is scheduled to go into production early in 1958, with first deliveries due in the Spring of 1958. The following details apply to the standard production version.

TYPE.—Four-engined Light Transport.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 9. All-metal structure. Fixed wing-tip fuel tanks act also as end-plates. Optional leading-edge de-icing boots. Wing area 340 sq. ft. (31.59 m.²).

FUSELAGE.—All-metal semi-monocoque structure. Provision for cloud warning radar in nose.

TAIL UNIT.—Cantilever monoplane type.



The Cessna Model 620.

All-metal structure. Optional leading-edge de-icing boots.

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Nose gear retracts forward into nose of fuselage and main units retract inward into wings. Oleo-pneumatic shock-absorbers. Goodyear wheels and single-disc brakes. Hydraulic brakes are power-boosted and equipped with manual override. Non-skid brakes and power steering optional. Wheelbase 12 ft. 8½ in. (3.87 m.). Wheel track 18 ft. 4 in. (5.58 m.).

POWER PLANT.—Four Continental GSO-526-A six-cylinder horizontally-opposed supercharged air-cooled engines, each with take-off rating of 340 h.p. at S/L. and with maximum continuous rating of 300 h.p. Three-blade constant-speed fully-feathering metal airscrews. Jet augmentors for engine cooling are automatic in operation, eliminating need for cowling flaps. Fuel in four cells in each wing and fixed tip-tanks. Two inboard cells in each wing interconnected as single tank. Two outboard cells in each wing and tip-tanks interconnected as single tank. Total fuel capacity 535 U.S. gallons (2,023 litres). Oil capacity of each engine 5 U.S. gallons (19 litres).

ACCOMMODATION.—Crew of two on flight deck with full dual controls. Layout based on airline practice. Main cabin is 13 ft. 3 in. long, 6 ft. high and 5 ft. 8 in. wide (4.04 × 1.83 × 1.72 m.) and permits a wide variety of interior arrangements for up to eleven persons. Baggage compartment with space for 50 cub. ft. (1.42 m.³) or 500 lb. (227 kg.) of baggage and rest room to rear of main cabin. Toilet adjoins baggage space. Passenger door at rear of cabin on port side, with integral steps. Interior of aircraft air-conditioned and pressurised to give equivalent of 8,000 ft. (2,440 m.) altitude at 18,000 ft. (5,490 m.).

DIMENSIONS.—
Span 55 ft. (16.76 m.).
Length 41 ft. 6½ in. (12.65 m.).
Height 16 ft. 5 in. (5.0 m.).

WEIGHTS.—
Weight empty 10,000 lb. (4,536 kg.).
Weight loaded 15,000 lb. (6,804 kg.).
Landing weight 14,285 lb. (6,480 kg.).
Wing loading 44.1 lb./sq. ft. (215.3 kg./m.²).
Power loading 10.7 lb./h.p. (4.85 kg./h.p.).

PERFORMANCE.—
Max. speed at 15,000 ft. (4,570 m.) 282 m.p.h. (454 km.h.).
Max. cruising speed at 12,500 ft. (3,800 m.) 260 m.p.h. (418 km.h.).
Max. rate of climb at S/L. 1,150 ft./min. (350 m./min.).
Service ceiling 25,000 ft. (7,620 m.).
Three-engine service ceiling (14,500 lb. = 6,576 kg. A.U.W.) 20,000 ft. (6,100 m.).
Take-off distance to clear 50 ft. (15.25 m.) at S/L., one engine out 3,750 ft. (1,143 m.).
Landing distance from 50 ft. (15.25 m.) at S/L. 3,050 ft. (930 m.).
Max. range at economical cruising speed at 15,000 ft. (4,570 m.) 1,700 miles (2,735 km.).
Max. endurance (55% power) 9 hrs.

THE CESSNA MODEL 318.

U.S.A.F. designation: T-37A.

Now in volume production, the T-37A is the first jet-trainer designed as such from the start to be used by the U.S.A.F. The first prototype XT-37 made its first flight on October 12, 1954. Production

deliveries were made in 1957 for service at the U.S.A.F. Air Training Command's civilian contract flight schools.

Cessna have projected a four-seat long-range "business" transport version of the T-37A with added wing-tip fuel tanks.

TYPE.—Two-seat Primary Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Hydraulically-operated all-metal high-lift slotted flaps inboard of ailerons. Total area of ailerons 11.39 sq. ft. (1.06 m.²). Total area of flaps 15.10 sq. ft. (1.40 m.²). Wing area 183.9 sq. ft. (17.09 m.²).

FUSELAGE.—All-metal structure. Hydraulically-actuated speed brake, below forward part of fuselage in region of cockpit, extends to a maximum angle of 66°.

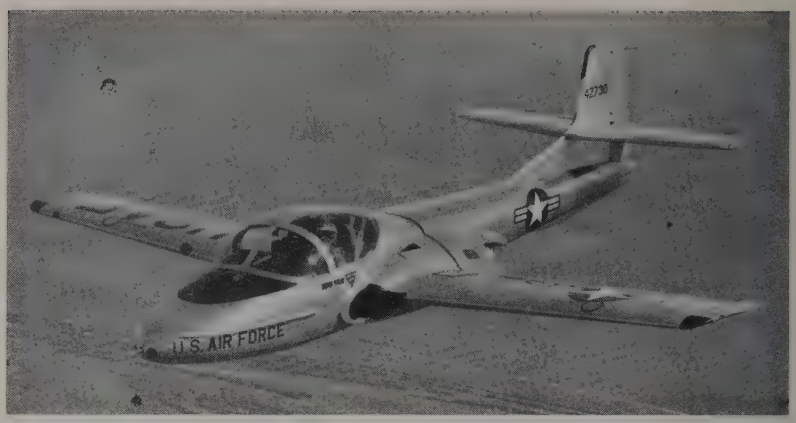
TAIL UNIT.—Cantilever monoplane type. All-metal structure. Fin integral with fuselage, tailplane mounted one-third of way up fin. Movable surfaces all have electrically-operated trim-tabs. Areas: fin 12.41 sq. ft. (1.15 m.²), rudder 6.24 sq. ft. (0.58 m.²), tailplane 31.45 sq. ft. (2.92 m.²), elevators 11.64 sq. ft. (1.08 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic actuation. Steerable nose-wheel. Main tyres 20 × 4.4. Nose-wheel tyre 600 × 6. Wheel brakes operated by separate hydraulic system controlled by dual rudder and brake pedals.

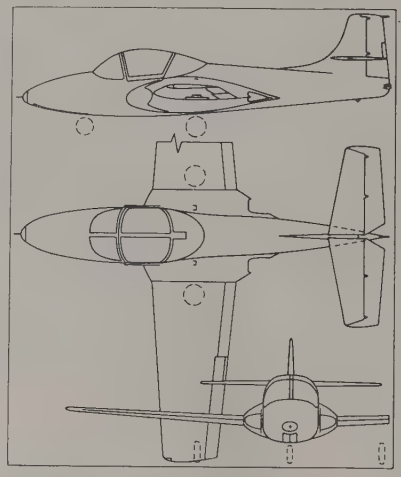
POWER PLANT.—Two Continental J69-T-9 turbojet engines each with 920 lb. (417 kg.) s.t. at 22,700 r.p.m. Air inlets and jet exits in thickened wing roots. Six rubber-cell inter-connected fuel tanks in wings feeding main tank in fuselage aft of cockpit. Total capacity 317 U.S. gallons (1,200 litres). Automatic fuel transfer by engine-driven pumps and submerged booster pumps.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual controls. Ejector seats and jettisonable clam-shell type canopy. Standardised cockpit lay-out, with flaps, speed brakes, trim-tabs, radio controls, etc. positioned and operated as in standard U.S.A.F. combat-type aircraft.

DIMENSIONS.—
Span 33 ft. 9½ in. (10.3 m.).
Length 29 ft. 4 in. (8.93 m.).
Height 9 ft. 4 in. (2.85 m.).



The Cessna T-37A Primary Trainer (two Continental J69 turbojet engines).



The Cessna T-37A.



The Cessna L-19A (213 h.p. Continental O-470 engine).

WEIGHTS.—
Weight empty 3,910 lb. (1,774 kg.).
Weight loaded 6,400 lb. (2,903 kg.).

PERFORMANCE.—
Max. speed over 400 m.p.h. (644 km.h.).
Range over 575 miles (925 km.).

THE CESSNA BIRD DOG.
U.S. Army Field Forces designation: L-19.
U.S. Marine Corps designation: OE-1.

The Bird Dog was developed for the U.S. Army Field Forces as a light reconnaissance and observation aircraft, which could also be used for liaison and training duties. The first contract for 14 aircraft was placed in June, 1950, and subsequent large contracts have kept the L-19 in production, with deliveries scheduled to continue through 1958. The following versions have been produced for the U.S. Services :—

L-19A. Standard observation and liaison version for U.S. Army Field Forces. Total of 2,480 built by October, 1954.

XL-19B. One only. Fitted experimentally with 210 h.p. Boeing XT50 turboprop.

XL-19C. Two only. Fitted experimentally with Continental XT51 (Turbomeca Artouste) turboprop.

TL-19D. Instrument trainer with dual controls, comprehensive instruments and radio communication and navigation equipment. Original contract for 100 followed by new order for more than 200, of which first deliveries were made in January, 1957.

L-19E. Current production version of standard observation and liaison aircraft. First of contract for 305 delivered late in 1956.

OE-1. Similar to L-19A for U.S. Marine Corps.

In addition to its contracts for the U.S. Army, Cessna is building 90 L-19's for the French Government and is delivering others to the Canadian Government.

During 1956, a licensing agreement was signed to permit manufacture of the L-19 in Japan by Fuji Heavy Industries of Tokyo, for use by the Japanese defence forces.

The L-19 seats a pilot and observer in tandem. A wide door, plus a push-out window and large rear cabin and baggage compartment, provide ample space for a standard stretcher, for which support brackets are fitted.

The power-plant consists of a 213 h.p. Continental O-470 six-cylinder horizontally-opposed air-cooled engine. Fuel is carried in tanks built into the wings, with a capacity of 42 U.S. gallons (160 litres).

Electrically-operated flaps, developed by Cessna, are being fitted to all new production L-19's and to the earlier aircraft as they pass through IRAN (Inspection, Repair as necessary) Modification Centers.

A winterisation kit has been developed by Cessna, which permits the L-19 to operate in temperatures as low as 60° below Zero. The equipment includes a 25,000 BThU heater, a collapsible 4-inch pre-heater hose, nose shutters, electric oil dilution unit, electric primer, internal de-frosters and a carburettor heater unit.

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 24 ft. 11½ in. (7.6 m.).
Height 7 ft. 6 in. (2.28 m.).



The Cessna TL-19D Instrument Trainer (213 h.p. Continental O-470 engine). (*Gordon Williams*).

WEIGHTS AND LOADINGS (L-19E).—
Weight empty 1,498 lb. (680 kg.).
Weight loaded (primary mission) 2,200 lb. (1,000 kg.).
Max. weight loaded (alternative missions) 2,430 lb. (1,103 kg.).
Wing loading 12.1 lb./sq. ft. (59 kg./m.²).
Power loading 11.5 lb./h.p. (5.22 kg./h.p.).
PERFORMANCE (L-19E).—
Max. speed 130 m.p.h. (208 km.h.).
Cruising speed (29% power) at 5,000 ft. (1,525 m.) 104 m.p.h. (166.4 km.h.).
Stalling speed 54 m.p.h. (86.4 km.h.).
Initial rate of climb 1,485 ft./min. (453 m./min.).
Service ceiling 22,900 ft. (6,985 m.).
Absolute ceiling 24,800 ft. (7,565 m.).
Cruising range 800 miles (1,280 km.).
Take-off over 50 ft. (15.25 m.) obstacle from grass 560 ft. (171 m.).
Landing from 50 ft. (15.25 m.) on grass 600 ft. (183 m.).



The Cessna OE-2 (265 h.p. Continental O-470-2 supercharged engine).

THE CESSNA MODEL 321.
U.S. Marine Corps designation: OE-2.

The Model 321 is a two-seat reconnaissance monoplane, of which 25 are in service with the U.S. Marine Corps.

Although similar in appearance to its predecessor, the OE-1, the OE-2 is a completely new aeroplane which exemplifies a new concept in liaison aircraft performance and equipment.

The OE-2 is powered by a 265 h.p. Continental O-470-2 supercharged engine.

Pilot and observer are protected against enemy fire by flak curtains and seat armour. The fuel tanks, which have a capacity of 52 U.S. gallons (197 litres), are semi-self-sealing.

Equipment includes specialised radio equipment for flexible communication with ground troops.

aircraft. The initial contract was for 80 aircraft.

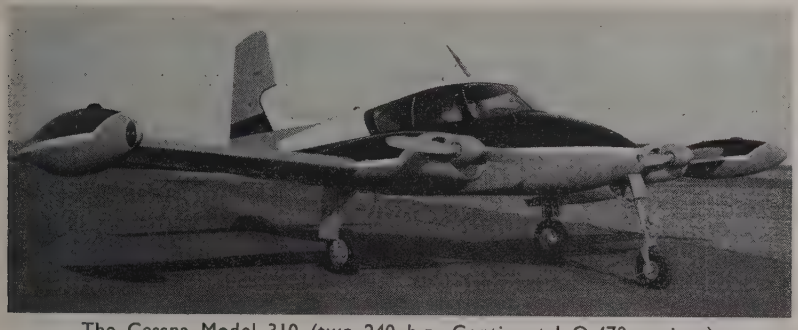
TYPE.—Twin-engined Five-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal flush-riveted structure. Electrically-operated split flaps between ailerons and fuselage. Maximum flap depression 45°. Wing area 175 sq. ft. (16.2 m.²).

FUSELAGE.—All-metal flush-riveted structure.

TAIL UNIT.—Cantilever monoplane type. All-metal flush-riveted structure. Trim-tabs in rudder and elevators.

LANDING GEAR.—Retractable nose-wheel type. Electro-mechanical retraction. Cessna type oleo shock-absorber struts. Nose-wheel steerable to 15° and castoring from 15° to 55° in both directions.



The Cessna Model 310 (two 240 h.p. Continental O-470 engines).

Other features which extend its versatility include its ability to carry a 250-lb. bomb or three rockets under each wing, a telephone wire-laying container, a chemical spray tank for laying smoke screens, or an aerial delivery container for dropping supplies.

WEIGHT.—
Max. loaded weight 2,650 lb. (1,202 kg.).
PERFORMANCE.—
Max. speed 185 m.p.h. (298 km.h.).
Initial rate of climb 1,300 ft./min. (395 m./min.).
Rate of climb at 10,000 ft. (3,050 m.) 1,100 ft./min. (335 m./min.).
Time to 20,000 ft. (6,100 m.) 22.6 min.
Range at 10,000 ft. (3,050 m.) 575 miles (925 km.).

THE CESSNA MODEL 310.
U.S.A.F. designation: L-27A.

The Model 310 is a twin-engined five-seat cabin monoplane, the prototype of which first flew on January 3, 1953. More than 500 have been built since the Model 310 went into production late in 1954.

An improved model, announced in July, 1957, is the Model 310B, with newly designed instrument panel, improved soundproofing, and improvements in cabin furnishing, lighting and equipment. The loaded weight of this version is 4,700 lb. (2,132 kg.).

The Cessna 310 was also chosen for service with the U.S.A.F. early in 1957, under the designation L-27A, as the result of a competition for a light twin-engined administrative liaison and cargo

POWER PLANT.—Two 240 h.p. Continental O-470-M six-cylinder horizontally-opposed air-cooled engines. Each engine exhausts into two stainless steel augmenter tubes terminating above wing ahead of trailing-edge. Two-blade metal constant-speed full-feathering airscrews. Fuel in two permanently-attached wing-tip tanks, each of which contains a bladder-type fuel cell holding 50 U.S. gallons (189 litres). Cross-feed fuel system. Each wing tank is also fitted with an electrical fuel boost pump. An optional 30 U.S. gallon (113 litres) auxiliary fuel system became available during 1956. It consists of two 15 U.S. gallon (56.5 litres) rubber fuel cells which are installed between the wing spars outboard of each engine nacelle and connected to the main fuel system. Total extra weight of the auxiliary fuel system is only 16 lb. (7.25 kg.). Oil capacity 6 U.S. gallons (22.7 litres).

ACCOMMODATION.—Cabin seats five, two in front and three on cross bench behind. Controlled heating provided by Stewart-Warner thermostatically-controlled blower-type heater. Large door on starboard side giving access to all seats. Baggage compartment aft of cabin with internal and external access. Baggage capacity 200 lb. (91 kg.).

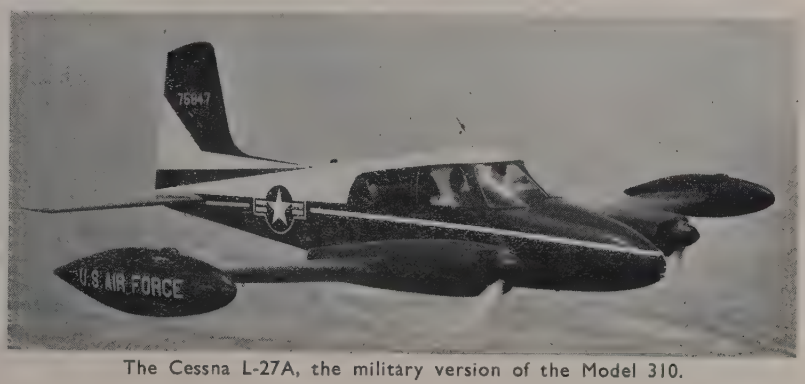
DIMENSIONS.—
Span 36 ft. 1 in. (11.0 m.).
Length 27 ft. 1 in. (8.26 m.).
Height 10 ft. 5 in. (3.17 m.).
WEIGHTS AND LOADINGS (Model 310).—
Weight empty 2,900 lb. (1,315 kg.).
Weight loaded (5 people, max. fuel and oil 225 lb.=102 kg. baggage and optional equipment) 4,600 lb. (2,088 kg.).
Wing loading 26.2 lb./sq. ft. (127.7 kg./m.²).
Power loading 9.6 lb./h.p. (4.35 kg./h.p.).
WEIGHT (Model 310B).—
Max. loaded weight 4,700 lb. (2,132 kg.).
PERFORMANCE (Model 310B at 4,700 lb.=2,132 kg. A.U.W.).—
Max. speed at S/L 232 m.p.h. (373 km.h.).
Cruising speed (70% power) at 8,000 ft. (2,440 m.) 213 m.p.h. (343 km.h.).
Rate of climb at S/L 1,660 ft./min. (505 m./min.).
Rate of climb on one engine at S/L 415 ft./min. (126 m./min.).
Service ceiling 20,500 ft. (6,250 m.).
Service ceiling on one engine 7,750 ft. (2,360 m.).
Cruising range (70% power) at 8,000 ft. (2,440 m.) 850 miles (1,368 km.).
Cruising range at 169 m.p.h. (272 km.h.) at 10,000 ft. (3,050 m.) 975 miles (1,570 km.).
Cruising range with auxiliary tanks (70% power) 1,107 miles (1,782 km.).

THE CESSNA MODEL 172.

The Model 172 is similar to the earlier Model 170, which it superseded in production, except for its tricycle landing gear. It was introduced in November, 1955 and more than 1,100 Model 172's were delivered during the first year's production.

TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing braced monoplane. NACA 2412 wing section. Aspect ratio 7.46. Dihedral 2° 8′. All-metal single-spar structure with metal skin. Single bracing strut on each side. NACA slotted flaps inboard of ailerons. Aileron area (total) 18.3 sq. ft. (1.70 m.²). Total flap area 21.23 sq. ft. (1.97 m.²). Gross wing area 174 sq. ft. (16.2 m.²).



The Cessna L-27A, the military version of the Model 310.

FUSELAGE.—All-metal monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Horn-balanced rudder and elevators. Areas: fin 9.0 sq. ft. (0.84 m.²), rudder 9.42 sq. ft. (0.87 m.²), elevators (total) 15.42 sq. ft. (1.43 m.²), tailplane 19.80 sq. ft. (1.84 m.²).

LANDING GEAR.—Cessna "Land-o-Matic" gear. Hydraulic wheel brakes. Nose-wheel is steerable with rudder up to 10° and controllable up to 30° on either side.

POWER PLANT.—One 145 h.p. Continental O-300-A six-cylinder horizontally-opposed air-cooled engine. McCauley two-blade metal airscrew. Fuel tanks in wings with total capacity of 42 U.S. gallons (159 litres).

ACCOMMODATION.—Cabin seats four in two pairs, front pair with dual controls. Baggage space aft of rear seats. 36-inch wide door on each side of cabin giving access to all seats and to simplify loading if rear seats removed and cabin used for freight. Combined heating and ventilation system. Fibreglass soundproofing.

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 25 ft. (7.62 m.).
Height 8 ft. 6 in. (2.59 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,260 lb. (572 kg.).
Weight loaded 2,200 lb. (1,000 kg.).
Wing loading 12.6 lb./sq. ft. (61.48 kg./m.²).
Power loading 15.2 lb./h.p. (6.9 kg./h.p.).

PERFORMANCE.—
Max. speed 135 m.p.h. (217 km.h.).
Max. recommended cruising speed 124 m.p.h. (199 km.h.).
Stalling speed 52 m.p.h. (83 km.h.).
Initial rate of climb 660 ft./min. (200 m./min.).
Service ceiling 13,300 ft. (4,050 m.).
Endurance at max. recommended cruising speed 4.2 hours.



The Cessna Model 172 (145 h.p. Continental O-300-A engine).

Initial rate of climb 1,130 ft./min. (336 m./min.).
Service ceiling 21,500 ft. (6,550 m.).
Max. range at 120 m.p.h. (193 km.h.) 845 miles (1,360 km.).
Endurance (cruising) 4.2 hours.

THE CESSNA MODEL 182.

First announced in March, 1956, the Model 182 is basically a Model 180 with a nose-wheel undercarriage, 230 h.p. Continental O-470-L engine and new "Flair Flight" features. The latter include single-action hand parking brake, external luggage door, redesigned seats and styling and other refinements.



The Cessna Model 180 (230 h.p. Continental O-470-K engine).

THE CESSNA MODEL 180.

The Model 180 is generally similar in layout and construction to the Model 172, but has a Cessna patented tail-wheel type landing gear, the main units of which are cantilever legs of chrome-vanadium spring steel fitted with castoring wheels. Hydraulic brakes are fitted to the main wheels, which have a track of 7 ft. 6½ in. (2.29 m.) and wheel fairings are optional. A steerable, fully-swivelling tail-wheel is fitted.

Alternatively, the Model 180 can be fitted with Edo Model 2000 floats, amphibious floats or skis.

A four-seater, the Model 180 is powered with a 230 h.p. Continental O-470-K engine driving an all-metal constant-speed airscrew. It has an outside luggage door.

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 26 ft. 2 in. (7.9 m.).
Height 7 ft. 6 in. (2.28 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,555 lb. (705 kg.).
Weight loaded 2,650 lb. (1,202 kg.).
Wing loading 15.2 lb./sq. ft. (74.2 kg./m.²).
Power loading 11.5 lb./h.p. (5.22 kg./h.p.).

PERFORMANCE.—
Max. speed 170 m.p.h. (274 km.h.).
Max. recommended cruising speed 160 m.p.h. (257 km.h.).

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 26 ft. (7.9 m.).
Height 8 ft. 6 in. (2.59 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,560 lb. (708 kg.).
Weight loaded 2,650 lb. (1,202 kg.).
Wing loading 15.1 lb./sq. ft. (73.7 kg./m.²).
Power loading 11.5 lb./h.p. (5.22 kg./h.p.).

PERFORMANCE.—
Max. speed 165 m.p.h. (265 km.h.).
Max. recommended cruising speed 155 m.p.h. (249 km.h.).
Initial rate of climb 1,030 ft./min. (315 m./min.).
Service ceiling 19,800 ft. (6,035 m.).
Max. range at 114 m.p.h. (183 km.h.) 805 miles (1,295 km.).
Endurance (with 65 U.S. gallons = 245 litres) over 4.2 hours.

THE CESSNA CH-1B HELICOPTER.
U.S. Army designation: YH-41 Seneca.

Cessna entered the helicopter field following its acquisition of the Seibel Helicopter Company in 1952. Charles Seibel continues as chief engineer of the company's helicopter department.

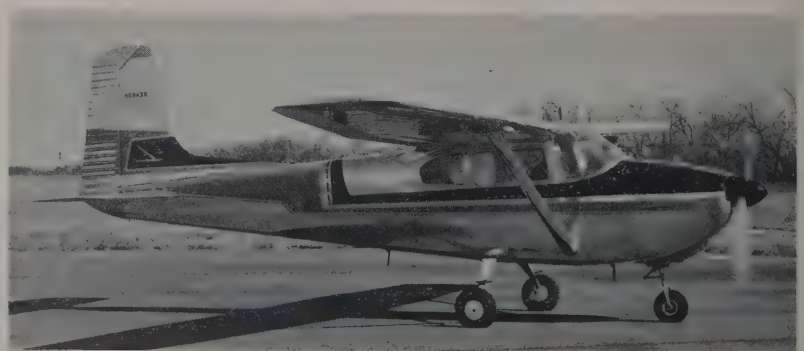
Work on Cessna's first helicopter began in the Summer of 1952. Following wind-tunnel tests, a flying test-bed to prove the control and transmission system was built and this test vehicle first flew in July, 1953. It was developed into the CH-1 which flew for the first time in July, 1954.

Further development resulted in the CH-1B, of which the U.S. Army has ordered an evaluation quantity under the name of YH-41 Seneca. Production and deliveries began during 1957.

The two most notable features of the CH-1B are the method of blade attachment to the main rotor hub, by means of flexible steel sheet L-section hinges which permit continuously-varying pitch of the blades without the need for pitch-change bearings; and the positioning of the engine in the nose of the fuselage, leaving greater passenger and/or cargo space near the C.G., and providing for better cooling and easier engine accessibility. The transmission system is also a simplified one, there being only three gears in the main transmission and two in the tail rotor assembly.

The CH-1B, which employs a two-blade main rotor and a conventional two-blade anti-torque rotor, is of all-metal construction and is powered by a Continental FSO-526-A supercharged fan-cooled engine which delivers 270 net h.p. to the transmission. The cabin seats four persons in two pairs.

On September 13, 1955, the CH-1 landed and took off on Pikes Peak at an altitude of 14,110 ft. (4,300 m.). At that height, hovering tests were made with one, two and three persons aboard.



The Cessna Model 182 (230 h.p. Continental O-470-L engine).

DIMENSIONS.—
Diameter of main rotor 35 ft. (9.30 m.).
Diameter of tail rotor 7 ft. 2.13 m.).
Fuselage length 32 ft. 8 in. (9.95 m.).
Fuselage width 5 ft. 4 in. (1.62 m.).
Height to top of cabin 7 ft. 1¾ in. (2.18 m.).
Overall length (main rotor fore and aft) 42 ft. 8 in. (13.0 m.)
Overall height 8 ft. 5 in. (2.57 m.).

WEIGHTS AND LOADINGS.—
Weight empty 2,050 lb. (930 kg.).
Disposable load 950 lb. (430 kg.).
Weight loaded 3,000 lb. (1,360 kg.).
Disc loading 3.12 lb./sq. ft. (15.22 kg./m.²).
Power loading 11.1 lb./h.p. (5.04 kg./h.p.).

PERFORMANCE (at 3,000 lb.=1,360 kg. A.U.W.).—
Max. speed at S/L. 124 m.p.h. (200 km.h.).
Cruising speed 100-124 m.p.h. (160-200 km.h.).
Rate of climb at S/L. 1,350 ft./min. (410 m./min.).
Climb to 10,000 ft. (3,050 m.) 11 min. 19 sec.
Hovering ceiling 11,000 ft. (3,355 m.).
Cruising range 290 miles (467 km.).
Endurance 3.8 hours.



The Cessna YH-41 Seneca Helicopter (270 h.p. Continental FSO-526 engine). (*Gordon Williams*).

CHAMPION

CHAMPION AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: OSCEOLA, WISCONSIN.

President: Robert Brown.

Vice-President in charge of Production: Henry Dickhudt.

The Champion Aircraft Corpn. was formed by Flyers Service, Inc. to build and market the Model 7 Champion light two-seat training and agricultural monoplane, the manufacturing rights of which were bought from the Aeronca Manufacturing Corporation in June, 1954. The purchase included the complete parts inventory and all tooling and engineering data of the Model 7 Champion, which is being developed and refined by Champion Aircraft. In addition, the company is handling the sale of spares and parts for existing Aeronca-built Champions and Chiefs.

Production of the Champion Model 7EC by Champion Aircraft began in late 1954 and the first aircraft came off the assembly line in February, 1955.

It has now been joined in production by the Champion Model 7FC, which is generally similar except that it has a tricycle landing gear instead of the tail-wheel type of the Model 7EC.

THE CHAMPION MODEL 7EC TRAVELER.

The Model 7 Champion was designed originally by Aeronca, who built over 10,000 of these aircraft between 1946 and 1951. The same basic design was also used for the L-16A and L-16B light liaison, reconnaissance and training aircraft, over 600 of which were supplied to the Army Ground Forces.

There are two versions of the Model 7EC. The standard version is known as the Traveler; while the Traveler Deluxe has a more luxuriously-furnished cabin.

TYPE.—Two-seat light cabin monoplane.

WINGS.—High-wing braced monoplane. NACA 4412 wing section. Aspect ratio 7.25. Chord 5 ft. (1.52 m.). Dihedral 2°. Incidence 1°. Two wood spars, aluminium ribs, fabric covering. Steel tube Vee bracing struts. Single-spar fabric-covered metal ailerons. No flaps. Total aileron area 12 sq. ft. (1.12 m.²). Gross wing area 170.22 sq. ft. (15.81 m.²).

FUSELAGE. — Welded chrome-molybdenum steel tube structure covered with fabric.

TAIL UNIT.—Wire-braced monoplane type. Tubular welded steel frames, fabric covering. Areas: fin 6.0 sq. ft. (0.55 m.²), rudder 6.8 sq. ft. (0.63 m.²), tailplane 14.08 sq. ft. (1.31 m.²), elevators 11.92 sq. ft. (1.11 m.²). Tailplane span 10 ft. 2¼ in. (3.12 m.).

LANDING GEAR.—Fixed divided-axle type. Oleo shock-absorber struts. Cleveland Model C-38500 wheels and Model C-7000 brakes. Steerable tail-wheel. Track 5 ft. 10 in. (1.78 m.).

POWER PLANT.—One 95 h.p. Continental O90-12F flat-four air-cooled engine driving McCauley (Met-L-Prop) Type IB90CM metal airscrew. Fuel in two 13 U.S. gallon (49 litres) wing tanks. Total fuel capacity 26 U.S. gallons (98 litres). Oil capacity 5 U.S. quarts (4.72 litres).

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. One-piece wrap-round windshield. Tinted transparent panels over baggage compartment, which accommodates 50 lb. (23 kg.) of luggage. Traveler Deluxe has foam seat cushions, floor carpeting, upholstered side panels, heater and air conditioning.

DIMENSIONS.—
Span 35 ft. 2 in. (10.72 m.).
Length 21 ft. 6 in. (6.56 m.).
Height (tail down) 7 ft. 2 in. (2.18 m.).

WEIGHTS.—
Weight empty 860 lb. (390 kg.).
Max. permissible loaded weight 1,450 lb. (658 kg.).

PERFORMANCE.—
Max speed 135 m.p.h. (216 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed (power on) 40 m.p.h. (64 km.h.).
Stalling speed (power off) 44 m.p.h. (70.4 km.h.).
Rate of climb at S/L. 800 ft./min. (244 m./min.).



The Champion Model 7FC Tri-Traveler (95 h.p. Continental C90 engine).

THE CHAMPION MODEL 7FC TRI-TRAVELER.

The Champion Model 7FC is similar to the previously-described Model 7EC Traveler Deluxe in every respect, except that it has a tricycle landing gear. The first production Model 7FC flew in February, 1957.

DIMENSIONS.—
Same as for Model 7EC except:—
Height 8 ft. (2.44 m.).

WEIGHTS.—
Weight empty 910 lb. (413 kg.).
Weight loaded 1,500 lb. (680 kg.).

PERFORMANCE.—
Same as for Model 7EC except:—
Cruising speed 105 m.p.h. (169 km.h.).
Take-off distance 250 ft. (76 m.).

CHANCE VOUGHT

CHANCE VOUGHT AIRCRAFT, INC.

HEAD OFFICE AND WORKS: DALLAS, TEXAS.

Chairman of the Board: C. J. McCarthy.

President: F. O. Detweiler.

Executive Vice-President: H. B. Sallada.

Vice-President, Engineering: R. C. Blaylock.

Vice-President, Production: G. K. Johnson.

Vice-President and Controller: C. E. Burt.

Vice-President, Sales and Service: W. P. Thayer.

Assistant to President: Keith Baker.

Treasurer: B. W. Whitten.

Secretary: J. J. Gaffney.

Chief Engineer—Aircraft: J. Russell Clark.

Chief Engineer—Missiles: S. O. Perry.

Chance Vought's current production aircraft is the F8U-1 Crusader, the first U.S. Navy carrier-based aircraft to be supersonic in level flight and the holder of the U.S. national speed record at 1,015.428 m.p.h. (1,634.17 km.h.). Chance Vought was given a development contract for the F8U in May, 1953 after winning a design competition in which eight airframe manufacturers had participated. The prototype XF8U-1 Crusader flew for the first time on March 25, 1955, exceeding the speed of sound in level flight. The first production F8U-1 flew on September 30, 1955 and following successful completion of the Fleet Introduction



The Chance Vought XRSSM-N-9 Regulus II Flight Test Vehicle with landing-gear.

Programme, the F8U-1 began reaching U.S. Naval operational squadrons in March, 1957. Navy Squadron NF-32 based at Cecil Field, Florida, was the first fighter unit to be equipped with the Crusader.

The F7U-3 twin-jet Cutlass fighter, which first joined the U.S. Fleet in 1954, is operating with both the Atlantic and Pacific Fleets and as a shore-based fighter. The Cutlass was the first production naval aircraft to achieve supersonic flight.

The Chance Vought Regulus, a surface-to-surface missile designed for launching from submarines, surface vessels and shore bases, was, in its Mk. I form, the U.S. Navy's first operational offensive missile. First conceived in 1947 and developed under the sponsorship of the Navy Bureau of Aeronautics, the Regulus I became operational in 1955 and saw extensive service with the Fleet in 1956.

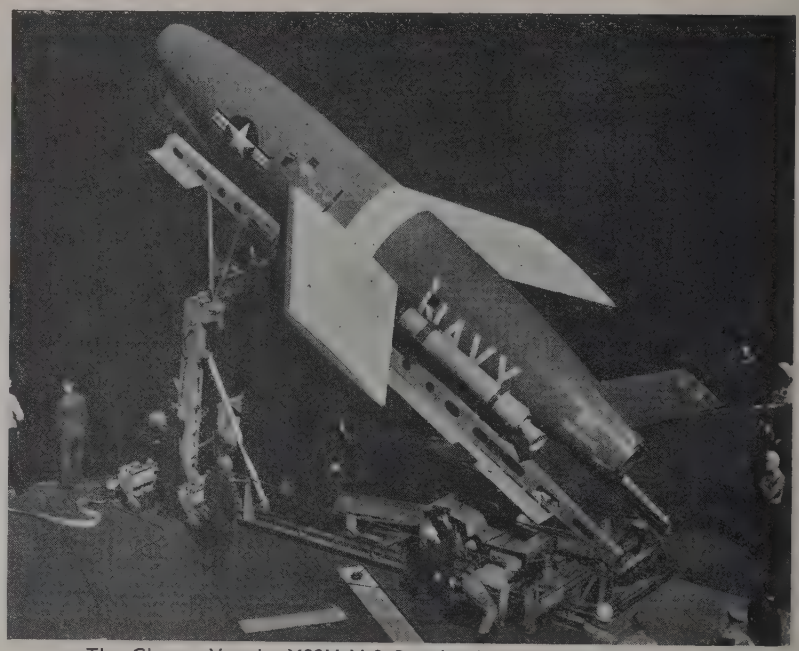
The existence of the Regulus II, a larger supersonic development of the Mk. 1, was officially announced by the U.S. Navy in March, 1957.

THE CHANCE VOUGHT REGULUS I.

The Regulus I, one of the few proven missiles in the United States, resembles a small swept-wing jet fighter aircraft and is powered by an Allison J33-A-18A turbojet engine (4,600 lb.=2,090 kg.), augmented for take-off by two Aerojet rocket boosters.

The Regulus I was produced during 1956 in three versions—as a ramp or trolley-launched tactical assault missile capable of operational missions from submarines, cruisers and aircraft carriers; as a target drone missile providing a high-speed target for interception practice; and as a recoverable missile, equipped with retractable landing-gear, for test purposes and the training of naval personnel.

By the beginning of 1957, ten carriers, four cruisers and two submarines were carrying the Regulus I. Other submarines are equipped to guide but not launch the missile.

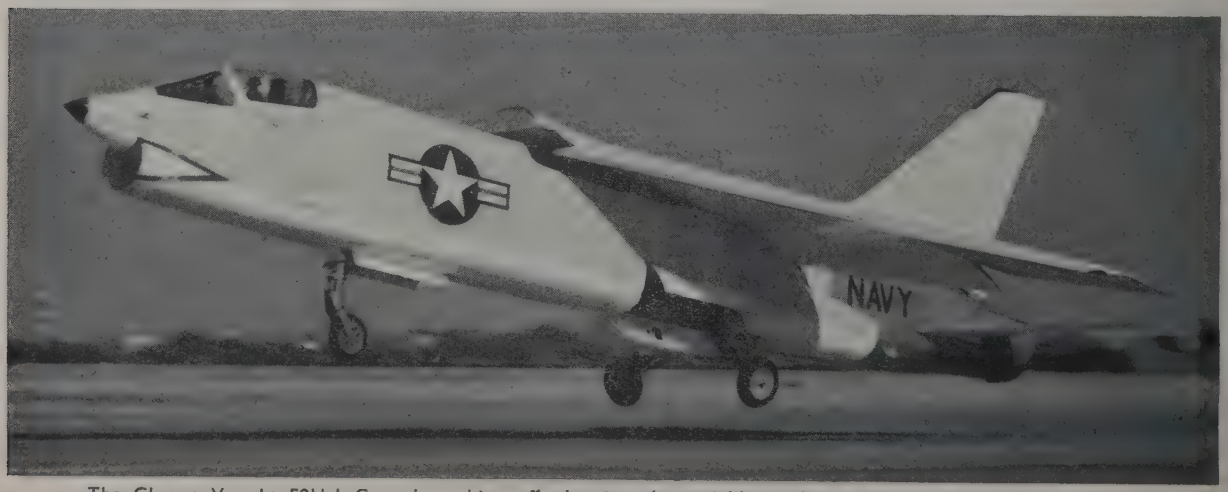


The Chance Vought XSSM-N-8 Regulus I on its launcher in the U.S. carrier *Hancock*.

DIMENSIONS.—
Span 21 ft. (6.405 m.).
Length 31 ft. (9.455 m.).

WEIGHT.—
Launching weight (less booster) 12,000 lb. (5,450 kg.).

PERFORMANCE.—
Max. speed Mach 0.98.



The Chance Vought F8U-1 Crusader taking off, showing the variable-incidence wing in the raised position.



A Chance Vought F8U-1 Crusader on the steam catapult of the U.S. Carrier *Bon Homme Richard*.

THE CHANCE VOUGHT REGULUS II.

The Regulus II is a large supersonic missile with the same tactical functions as the Mk. I. By March, 1957, when its existence was officially recognised, the Regulus II, in test vehicle form with tricycle landing-gear, had made 13 successful flights, had flown at Mach 1.5 and had proven itself at more than 50,000 ft. (15,250 m.).

The test version of the Regulus II, which was first flown on May 29, 1956, is powered by a Curtiss-Wright J65 engine but the production version will have the General Electric J79 turbojet engine with afterburner.

The Regulus II is fitted with Sperry-developed autopilot, beacons and recovery system as for the Regulus I. Guidance control is by ailerons and rudder. The small stabiliser surfaces forward of the wings near the nose of the Regulus II are fixed.

DIMENSIONS.—
Span about 20 ft. (6.10 m.).
Length about 57 ft. (17.385 m.).
PERFORMANCE.—
Max. speed Mach 1.5.
Operational altitude 50,000 ft. (15,250 m.) and over.
Range 800-1,000 miles (1,280-1,600 km.).

THE CHANCE VOUGHT CRUSADER.

U.S. Navy designation : F8U.

The Crusader is a single-seat supersonic carrier fighter, the general plan of which marks a substantial departure from that of previous Chance Vought naval fighters. The XF8U-1 exceeded Mach 1 on its first flight, which was made on March 25, 1955.

The first production F8U-1 flew for the first time on September 30, 1955 and completed its carrier qualification trials in the U.S.S. *Forrestal* in April, 1956. The first production F8U-1 Crusaders were delivered to the U.S. Navy on December 28, 1956, only twenty-one months from the date of the first flight of the first prototype and twenty-six months from the completion of the original mock-up.

On August 21, 1956, an F8U-1 set up a new U.S. national speed record of 1,015.428 m.p.h. (1,634.17 km.h.). On July 16, 1957, an F8U-1P photo-reconnaissance version of the Crusader set up a new U.S. transcontinental record by flying the 2,445.9 miles (3,936 km.) from Los Angeles to New York in 3 hr. 23 min. 8.4 sec., at an average speed of 723.52 m.p.h. (1,164.39 km.h.), equivalent to an average of Mach 1.1 at 35,000 ft. (10,670 m.). The F8U-1P was refuelled in flight by AJ-2 Savage tankers.

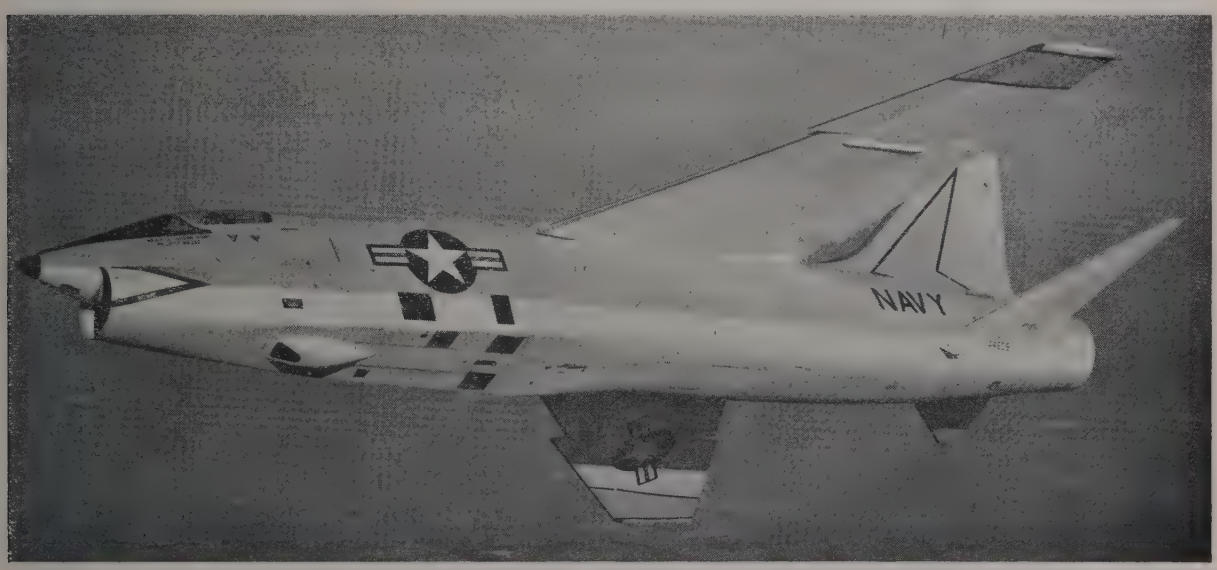
The principal feature of the F8U is its two-position variable-incidence wing. This provides a coarse angle of attack for take-off and landing, while permitting the fuselage to remain almost parallel to a flight deck or runway for good pilot visibility.

The following versions of the F8U have been mentioned :—

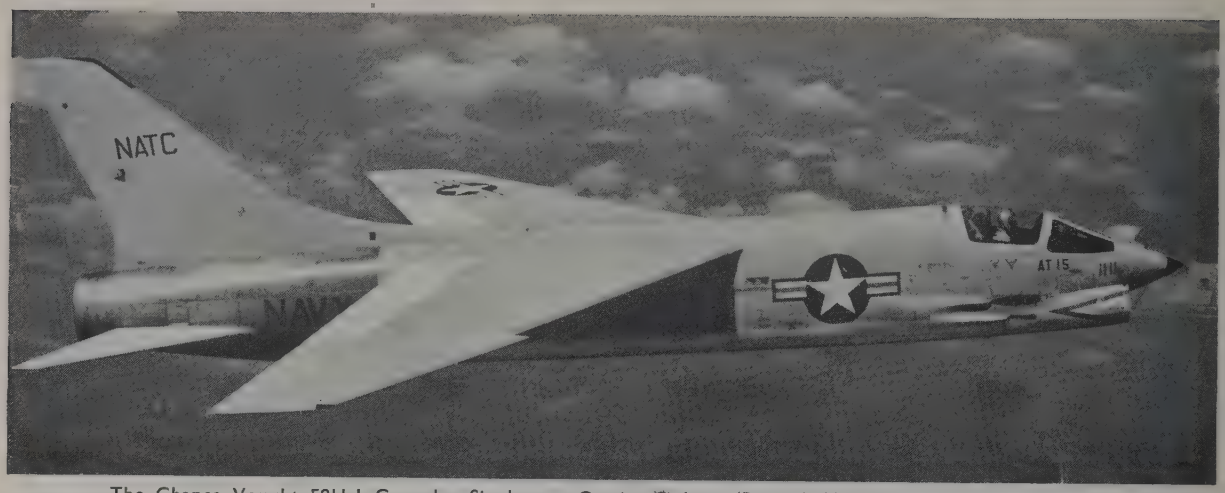
F8U-1. First production version. Brief description below refers to this version. One F8U-1 is being flown with a turbojet-rocket mixed-power plant and this may have something to do with the F8U-3, an improved version of the F8U-1 which is under development and reputed to have a designed speed of Mach 2.

F8U-1P. Photographic-reconnaissance version of -1 which first flew late in 1956. Capable also of special mapping and charting missions, and night reconnaissance. Fuselage undersurface slightly squared around camera bay.

F8U-3. Improved version of -1 referred to above. In very early stage of development. Pratt & Whitney J75 turbojet, plus rocket.



The Chance Vought F8U-1P, the photographic-reconnaissance version of the Crusader.



The Chance Vought F8U-1 Crusader Single-seat Carrier Fighter (Pratt & Whitney J57 turbojet engine).

The brief details below refer specifically to the F8U-1.

TYPE.—Supersonic single-seat Carrier Fighter.

WINGS.—Cantilever swept-wing monoplane. Thin laminar-flow section. Wing is adjustable to two incidence positions by Aeroproducts hydraulic self-locking actuators. Outer wing sections fold upwards for carrier stowage. All-metal multi-spar structure with sculptured magnesium-alloy upper and lower skins. Drooping "dog-tooth" leading-edges.

FUSELAGE. All-metal structure in three main assemblies. Both magnesium-alloy and titanium are used in structure, the after section and a portion of the mid-section being of titanium, while 25 per cent of wing and fuselage skins are of magnesium.

TAIL UNIT.—Large swept vertical fin and rudder and powered one-piece horizontal "slab" tail.

LANDING GEAR.—Retractable tricycle gear with all wheels retracting into fuselage. Hydraulic actuation.

POWER PLANT.—One Pratt & Whitney J57-P-12 turbojet engine with afterburner. Integral fuel tanks in wings inboard of wing fold. Provision for in-flight refuelling, with retractable probe housed in removable pack on port side of fuselage of F8U-1 and inside flush panel on F8U-1P.

ACCOMMODATION.—Pressurised cockpit in nose of fuselage with good forward and downward visibility. Lightweight ejector seat (30 lb. = 13.6 kg.). Oxygen equipment.

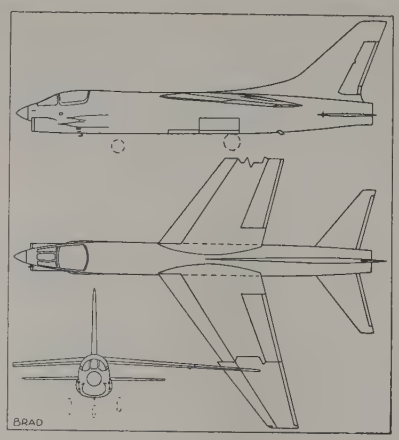
ARMAMENT.—Four 20 mm. cannon in fuselage nose. Retractable fuselage belly pack for eight air-to-air missiles.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—Restricted.

THE CHANCE VOUGHT CUTLASS.

U.S. Navy designation: F7U.

The Cutlass is a swept-wing tail-less single-seat twin-jet aircraft which is in service with the U.S. Navy in several forms. Production of the F7U-3 ceased in December, 1955.



The Chance Vought F8U-1 Crusader.

The Cutlass wing, which is of symmetrical section and has a sweepback of 35° at quarter chord, is fitted with full-span leading-edge slats, air brakes, power-operated irreversible "ailavators," or combined ailerons and elevators, and vertical fin and rudder surfaces. The "ailavators" are operated by two completely independent hydraulic power control systems connected in tandem. There is no direct mechanical linkage between control stick in the cockpit and the "ailavator" surfaces.

The Cutlass was the first production naval aircraft to achieve supersonic flight, the first to release bombs at a speed greater than that of sound and the first to be catapulted from a carrier while carrying nearly 5,000 lb. of external stores and weapons. The Cutlass was the first fighter to have incorporated in its design the use of afterburners, full power controls with an "artificial feel" system and an automatic stabilisation system.

The four following versions of the Cutlass have been announced :—

F7U-1. Two Westinghouse J34-WE-32 turbojets with afterburners. First prototype XF7U-1 flew on September 29, 1948. First production F7U-1 flew on March 1, 1950. Fourteen built. Used for training and operational evaluation for aircraft-carrier use.

F7U-3. Two Westinghouse J46-WE-8 turbojet engines (6,000 lb. = 2,725 kg. s.t. each) with afterburners. It is larger, has more power, carries a heavier armament load and has better maintenance characteristics than the F7U-1. Fitted with folding wings and arrester-gear for carrier operations. Standard armament consists of four 20 mm. cannon and a new type of rocket launcher carrying "Mighty Mouse" missiles. Normally one pack is mounted under the fuselage but two further packs can be carried under the wings for "strike" missions.

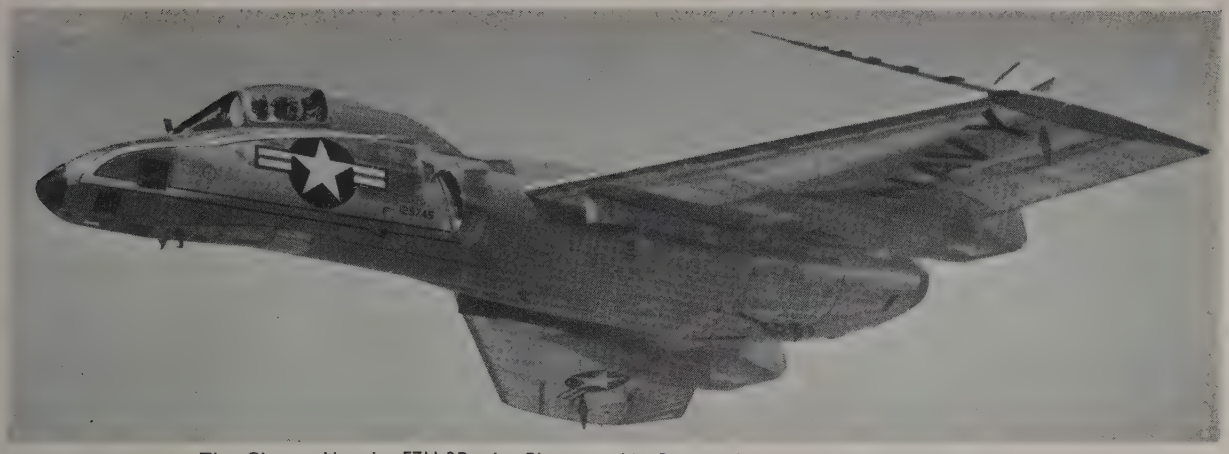
The first production F7U-3 flew for the first time on December 20, 1951, and the aircraft went into production in 1953. First deliveries to the U.S. Navy were made in February, 1954.

F7U-3P. Photographic reconnaissance version of F7U-3. Elongated nose to house camera equipment. This version is illustrated on page 271. First flew July, 1955.

F7U-3M. Missile-carrying version of



The Chance Vought F7U-3M Cutlass armed with four Sparrow I missiles. (*Gordon Williams*).



The Chance Vought F7U-3P, the Photographic Reconnaissance version of the Cutlass.

the F7U-3. Armed with four Sparrow I supersonic beam-riding missiles.

DIMENSIONS (F7U-3).—
Span 39 ft. 8½ in. (12.10 m.).
Length 44 ft. 3½ in. (13.50 m.).
Height 14 ft 7.4 in. (4.45 m.).

WEIGHTS.—
Weight empty 18,210 lb. (8,267 kg.).
Normal loaded weight 27,340 lb. (12,412 kg.).
Max. loaded weight 31,642 lb. (14,365 kg.).

PERFORMANCE.—
Max. speed more than 650 m.p.h. (1,040 km.h.).
Rate of climb (with afterburner) approx. 13,000 ft./min. (3,965 m./min.).
Service ceiling approx. 40,000 ft. (12,200 m.).

COLONIAL

COLONIAL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: SANFORD, MAINE.

President: David B. Thurston.

The Colonial Aircraft Corpn. was formed in 1946 by Mr. D. B. Thurston and a group of four other designers and builders to build the Skimmer single-engined pusher amphibian flying-boat. The prototype was first flown on July 17, 1948, and the Skimmer received C.A.A. Type Certificate 1A13 on September 19, 1955.

By the Spring of 1957, eighteen Skimmers had been built, the 18th having been delivered to the Surinam Timber Development Company of Dutch Guiana.

THE COLONIAL MODEL C-1 SKIMMER.

TYPE.—Single-engined 2/3-seat Amphibian.

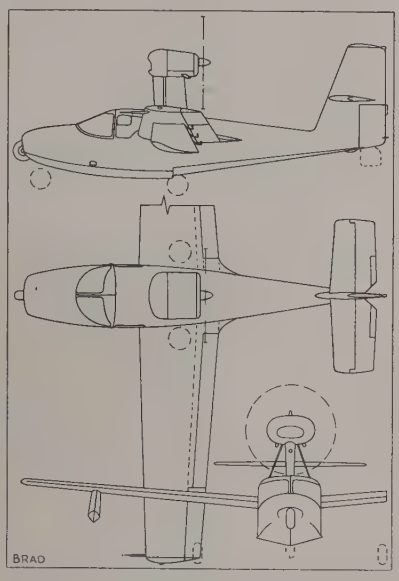
WINGS.—Cantilever shoulder-wing monoplane with tapered wing sections attached directly to sides of hull. Structure consists of duralumin leading and trailing-edge torque boxes separated by a single duralumin main spar or beam. All-metal ailerons. Hydraulically-operated slotted flaps over 80 per cent. of span. Gross wing area 150.6 sq. ft. (14 m.²).

HULL.—Single-step all-metal structure, with five watertight compartments.

TAIL UNIT.—Cantilever monoplane type. All-metal construction. Controllable elevator trim-tabs. Span of tail 10 ft. (3.05 m.), vertical tail area 22.7 sq. ft. (2.1 m.²), horizontal tail area 26.39 sq. ft. (2.45 m.²).

LANDING GEAR.—Retractable tricycle type. Knee-action oleo struts on main gear, which retracts into wings. Long-stroke nose-wheel oleo. Nose-wheel protrudes when retracted to serve as bumper. Hydraulic retraction using a pressurised accumulator-reservoir as a source of energy. Goodrich wheels, tyres and hydraulic brakes. Nose-wheel is free to swivel 30° either way.

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine mounted on pylon above hull and driving a Hartzell constant-speed airscrew 6 ft. 2 in. (1.8 m.) diameter. Normal fuel capacity 30 U.S. gallons (113 litres). Overload fuel capacity 39 U.S. gallons (148 litres).



The Colonial Skimmer.

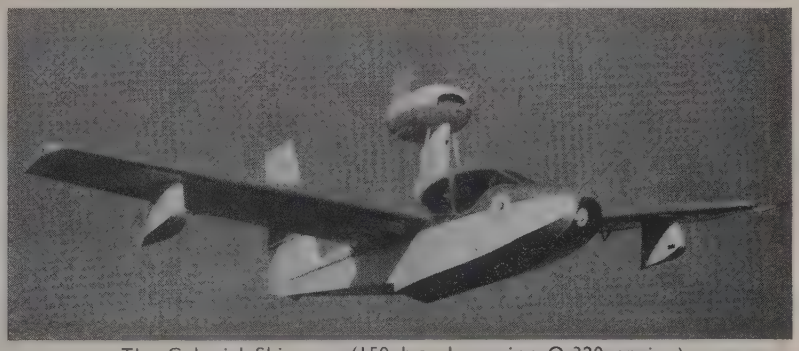
ACCOMMODATION.—Enclosed cabin normally seating two side-by-side, but third person (or two children) may be seated behind. Single wheel control standard but dual controls available. Blind-flying instruments, two-way VHF radio and landing lights optional. Baggage capacity of over 24 cub. ft. (0.68 m.³) available in passenger compartment.

EQUIPMENT.—Towbar, paddle and anchor.

DIMENSIONS.—
Span 34 ft. (10.37 m.).
Length 23 ft. 6 in. (7.16 m.).
Height overall 8 ft. 10 in. (2.68 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,425 lb. (646 kg.).
Disposable load 725 lb. (329 kg.).
Weight loaded 2,150 lb. (975 kg.).
Wing loading 14.27 lb./sq. ft. (69.67 kg./m.²).
Power loading 14.33 lb./h.p. (6.50 kg./h.p.).

PERFORMANCE.—
Max. speed at 5,000 ft. (1,525 m.) 125 m.p.h. (201 km.h.).
Cruising speed 123 m.p.h. (198 km.h.).
Stalling speed 50 m.p.h. (80 km.h.).
Initial rate of climb 700 ft./min. (213 m./min.).
Take-off distance on water in still air 1,500 ft. (457 m.).
Take-off distance on land in still air 550 ft. (168 m.).
Cruising range 500 miles (805 km.).



The Colonial Skimmer (150 h.p. Lycoming O-320 engine).

CONVAIR

CONVAIR DIVISION OF GENERAL DYNAMICS CORPORATION.

HEAD OFFICE: SAN DIEGO 12, CAL.

MANUFACTURING DIVISIONS: SAN DIEGO (2) AND POMONA, CAL. AND FORT WORTH, TEX.

President: Joseph T. McNarney.

Executive Assistant to President: E. P. Wohl.

Executive Vice-President: J. V. Naish.

Vice-President and Assistant to President: T. G. Lanphier.

Vice-President: R. H. Biron, Jr.

Vice-President—Engineering: R. C. Sebold.

Vice-President and General Counsel: R. B. Watts.

Vice-President and Manager, Fort Worth Division: A. C. Esenwein.

Vice-President and Manager, San Diego Division: Bernard F. Coggan.

Vice-President and Manager, Pomona Division: Charles F. Horne.

Manager, Astronautics Division (San Diego): J. R. Dempsey.

Manager, Daingerfield Division: J. E. Arnold.

Controller: R. R. Brewton.

Secretary: Edmund Burke.

Treasurer: G. T. Bovee.

Consolidated Vultee Aircraft Corporation resulted from the merger on March 17, 1943, of the properties of the Consolidated Aircraft Corporation and Vultee Aircraft, Inc. The original Consolidated Aircraft Corporation had been incorporated on May 29, 1923.

Before the merger with Vultee in 1943,



The Convair F-106A Delta Dart (Pratt & Whitney J75 turbojet engine with afterburner).

Consolidated acquired the Thomas-Morse Aircraft Corporation of Ithaca, N.Y., and the Hall Aluminium Aircraft Corporation.

On March 1, 1954, the directors of Consolidated Vultee and the General Dynamics Corporation, which had become the largest shareholder in Convair during 1953, voted to merge the two Corporations and on April 29, 1954, Consolidated Vultee became the Convair Division of General Dynamics Corporation.

The present activities of the manufacturing divisions may be summarised as follows :—San Diego Division : production of the Convair Metropolitan 440 and Convair 880 transports ; the F-102A delta-wing supersonic interceptor fighter and TF-102A trainer ; the F-106A and F-106B supersonic all-weather interceptors ; development of the F2Y-1 Sea-Dart experimental delta-wing fighter type seaplane ; and research and development in pilotless aircraft, guided missiles, new types of pilot ejection seat for supersonic aircraft and other restricted projects : Pomona Division :—research, development and production of guided missiles for the U.S. Navy Bureau of Ordnance ; Fort Worth Division :—production of the B-58 and research and development work on restricted projects : Astronautics Division (at San Diego) ; design, development, manufacturing and testing of the Atlas intercontinental ballistic missile (ICBM) and preliminary design work concerned with space travel. The Division's own large new plant will be fully occupied by early 1958.

The Daingerfield Division at Daingerfield, Texas, operates for the U.S. Navy Bureau of Ordnance a highly-important but little publicised Ordnance Aerophysics Laboratory which includes a supersonic wind-tunnel and a ramjet burner test centre for the development of guided missiles.

THE CONVAIR DELTA DART.

U.S.A.F. designation: F-106.

The F-106 is a developed version of the F-102. It was formerly designated F-102B ; but because of structural changes and use of the more powerful Pratt & Whitney J75 turbojet with afterburner, it has been redesignated.

Externally evident changes compared with the F-102A are a revised square-tip fin shape and repositioning of the engine air intakes further aft on the fuselage.

Two versions have been ordered into large-scale production for the U.S.A.F., as follows :—

F-106A. Initial production version. Prototype first flew at Edwards Air Force Base, Calif., on December 26, 1956.

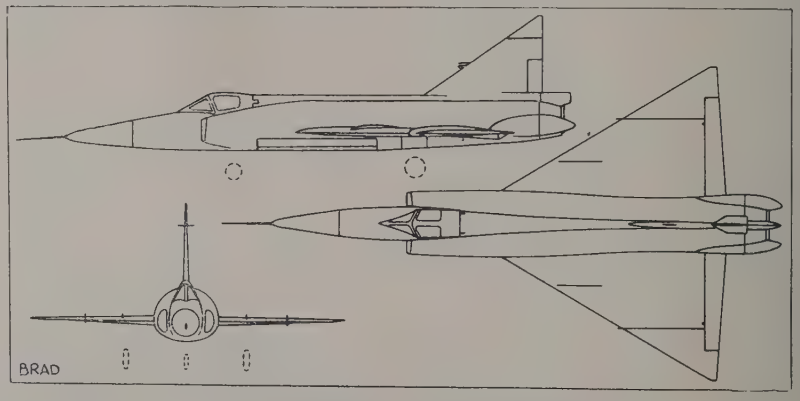
F-106B. Tandem two-seat version, ordered into parallel production with F-106A in April, 1957.

Both versions are supersonic all-weather interceptors and it has been stated that the F-106A carries the most sophisticated armament and fire control system yet developed for an interceptor aircraft. The standard designed armament is reported to be two Douglas MB-1 Genie air-to-air missiles with nuclear warhead, plus a number of Hughes Falcon missiles. No other details are available.

THE CONVAIR DELTA DAGGER.

U.S.A.F. designation: F-102.

The F-102 is a supersonic single-seat all-weather delta-wing fighter which is in production at San Diego. It is fitted with an automatic electronic control system which needs only to be monitored by the



The Convair F-102A Delta Dagger.



The Convair F-102A Delta Dagger (Pratt & Whitney J57 turbojet engine with afterburner).



The Convair F-102A Delta Dagger All-weather Interceptor (Pratt & Whitney J57 turbojet engine with afterburner). (*Warren Bodie*).

pilot and its main armament of six Hughes GAR-1D Falcon guided missiles is automatically fired.

Design of the F-102 began in 1951, after Convair had won a U.S.A.F. competition for an interceptor to carry the Falcon and its associated fire control system. As far as possible, it was a direct 1.22 : 1 scale-up of the earlier Convair XF-92A research aircraft, which was the first true delta-wing aeroplane to fly ; but in detail the F-102 was largely re-designed, making extensive use of pressings made from very large forgings to speed production.

The following versions have appeared:—

YF-102. Two prototypes, powered by Pratt & Whitney J57-P-11 turbojet with afterburner. First YF-102 flew on October 24, 1953 ; second on January 11, 1954. Initial production aircraft of this type were subsequently modified to virtual F-102A standard.

YF-102A. Developed version incorporating major design changes found essential for flight to transonic and supersonic speeds. Longer fuselage incorporating the NACA "area-rule" that gives the fuselage a pinched-in waisted effect just forward of streamlined fairings at the aft end of the fuselage. Delta wing given cambered leading-edges and swept-up wing-tips. Canopy re-designed to give the pilot greater visibility. More powerful J57 turbojet. Design generally improved for easier production and servicing. Re-design took 117 working days and first YF-102A flew on December 20, 1954. It exceeded the speed of sound in level flight on the following day.

F-102A. Production version, described below. About 500 delivered since mid-1956. Current contracts extend production into mid-1958. One F-102A was converted for evaluation in tactical rôle in the Spring of 1957.

TF-102A. Two-seat combat proficiency trainer and tactical interceptor version of F-102A. Length reduced to 63 ft. 4½ in. (19.32 m.). In production.

F-102B. Developed and extensively redesigned all-weather interceptor version. Redesignated F-106A and described separately.

TYPE.—Single-seat All-weather interceptor.

WINGS.—Cantilever mid-wing monoplane of delta shape. Leading-edge sweepback 60° 6′ 13″. Root chord 29 ft. 9¼ in. (9.07 m.). All-metal structure with five forged one-piece spars in each wing. Machined aluminium alloy (Alcoa 2024-T86) skins. Conical camber leading edge. Integral fuel tank bays fore and aft of landing gear bay. Elevons of bonded honeycomb construction, each divided into inner and outer sections operated by irreversible hydraulic jacks.

FUSELAGE.—All-metal semi-monocoque structure, with titanium alloy frames in vicinity of power plant.

TAIL UNIT.—Vertical fin and rudder only, of all-metal construction. Height of fin increased from 104 in. (264 cm.) to 137 in. (348 cm.) on later production aircraft by reducing leading-edge sweepback to 52°. Areas : fin 83.75 sq. ft. (7.78 m.²), rudder 11.25 sq. ft. (1.04 m.²). Braking parachute housed inside forward-opening speed brakes aft of fin.

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Menasco shock-absorber units. Wheel track 14 ft. 2¼ in. (4.32 m.). Wheelbase 22 ft. 4½ in. (6.86 m.).

POWER PLANT.—One Pratt & Whitney J57-P-35 turbojet engine, rated at 10,900 lb. (4,945 kg.) dry and 17,000 lb. (7,710 kg.) with afterburner in operation. Fuel in two integral tanks in each wing and in fuselage aft of missile bay.

ACCOMMODATION.—Pilot seated on Weber ejection seat in air-conditioned and pressurised cockpit. Normal pressurisation 7.2 lb./sq. in. (0.506 kg./cm.²) requires use of MC-1 partial-pressure suit above 50,000 ft. (15,240 m.). Vee-shaped windscreen with de-misting. Rearward-hinged stretched plastic canopy.

ARMAMENT.—Six Hughes GAR-1D Falcon air-to-air guided missiles mounted on short rails which extend from three missile bays when rapid-acting doors are opened. Secondary armament of 2.75 in. folding fin rockets in firing channels built into missile bay doors. Primary armament fired automatically by Hughes MG-10 fire control system mounted in fuselage nose.

DIMENSIONS.—
Span 38 ft. 1½ in. (11.62 m.).
Length 68 ft 3 in. (20.81 m.).
Height 20 ft. 7½ in. (6.27 m.).

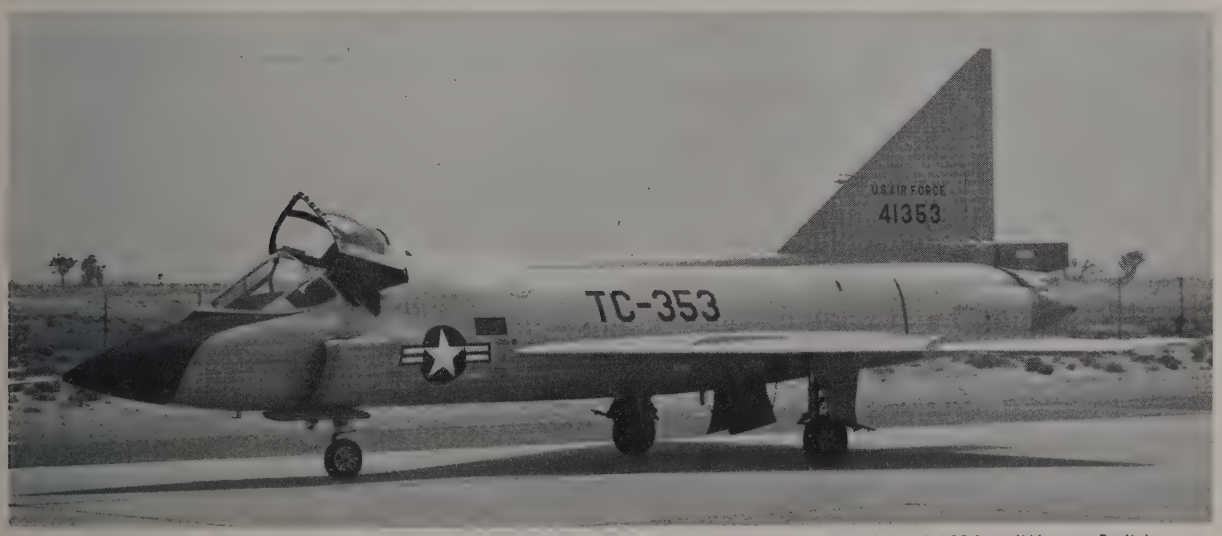
WEIGHTS AND PERFORMANCE.—
No details available.

THE CONVAIR TRADEWIND.
U.S. Navy designation: R3Y.

The R3Y is a long-range tanker-transport flying-boat which incorporates the latest developments in flying-boat hulls as evolved by Convair's Hydrodynamic Research Laboratory at San Diego. The R3Y's hull has a length-to-beam ratio of 10 to 1, double that of previous Convair flying-boats.

The R3Y has been built for the U.S. Navy in two versions. These are distinguished as follows :—

R3Y-1. Four 5,500 h.p. Allison T40-



The Convair TF-102A, the Two-seat Combat Trainer and Tactical Interceptor version of the F-102A. (*Warren Bodie*).



A Convair R3Y-2 Tradewind refuelling four Grumman F9F Cougar fighters.

A-10 turboprop engines. First production version. Can carry personnel or cargo, or may be fitted as an ambulance for the transport of both stretcher or sitting cases. All personnel seats of backward-facing type. Large 10 ft. (3.0 m.) wide cargo-loading door on port side aft of wings, with smaller personnel-loading doors on both sides of hull. Entire accommodation pressurised and air-conditioned.

First production R3Y-1 flew for the first time on February 25, 1954. Total of five built.

R3Y-2. Similar to R3Y-1 except that nose section of hull is hinged to swing upwards to permit direct loading of vehicles, heavy freight, etc. Flight deck raised to give clear passage beneath. Main cargo deck 88 ft. (26.8 m.) long and over 9 ft. (2.7 m.) wide. Bow-loading door 6 ft. 8 in. (2.0 m.) high and 8 ft. 4 in. (2.5 m.) wide. Built-in ramp folds down when bow door is open for direct loading from beach or quay. The aircraft can accommodate four 155 mm. howitzers, or three 2½-ton trucks, or six Jeeps, or two half track vehicles or several other types of military equipment up to maximum payload of 48,000 lb. (21,770 kg.). Large cargo-loading door aft of wings. Can also be fitted with 80 demountable rearward-facing seats or can carry 72 stretcher cases plus twelve medical attendants.

First R3Y-2 flew for the first time on October 22, 1954. Total of six built.

Both the R3Y-1 and R3Y-2 went into service with the U.S. Navy's Fleet Logistic Wings, Pacific, in 1956. They carry a normal crew of five.

One R3Y has been fitted with in-flight refuelling equipment and has refueled simultaneously four U.S. Navy jet fighters in less than five minutes. By using two of its own four tanks for jet fighter fuel the R3Y can carry enough to service eight fighters. All eleven R3Y's will eventually be equipped for flight refuelling.

Using the Flight Refuelling "probe-and-drogue" method, the R3Y is fitted with four plastic pods, each containing a drogue and hose-reel, two under each wing. Fuel is normally drawn from special internal refuelling tanks and flows at the rate of 250 gallons per minute while the probe and drogue are engaged. Valves open and close automatically when the probe-drogue connections are made and broken respectively.

DIMENSIONS.
Span 145 ft. (44.2 m.).
Length 142 ft. 6 in. (43.5 m.).
Height (on beaching cradle) 51 ft. 5 in. (15.7 m.).

WEIGHT.—
Weight loaded (normal) 165,000 lb. (74,845 kg.).
Weight loaded (max.) 175,000 lb. (79,380 kg.).

PERFORMANCE.—
Max. speed over 350 m.p.h. (560 km.h.) at 25,000 ft. (7,620 m.).
Cruising speed about 300 m.p.h. (480 km.h.).
Rate of climb at S.L. 2,500 ft./min. (760 m./min.).
Max. Range 4,000 miles (6,400 km.).

THE CONVAIR WS-125A.

Convair are developing a long-range nuclear-powered bomber for the U.S.A.F. under the Weapons System designation WS-125A. No details are available.

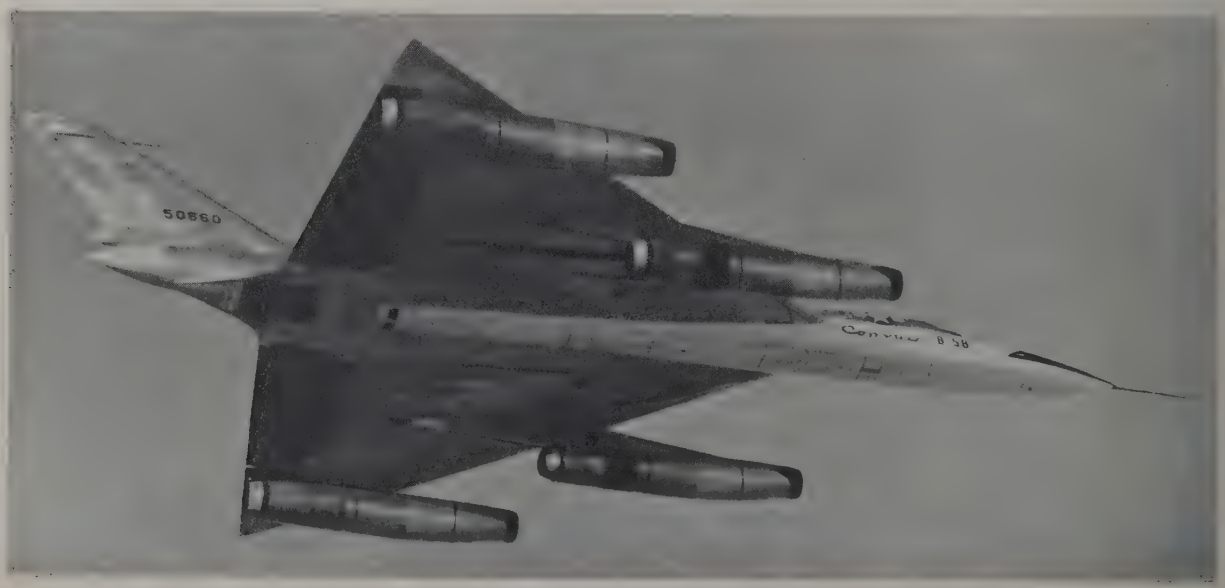
THE CONVAIR HUSTLER.

U.S.A.F. designation: B-58.

The B-58 is a multi-engined supersonic delta-wing bomber which was developed under the U.S.A.F.'s "weapon system concept." This makes Convair responsible not only for the airframe but for finding, developing, buying and installing all items of equipment (except engines) previously furnished by the government. As a result large contracts have been placed with seven "systems vendors" and 21 major sub-contractors. In addition, there are an estimated 1,500 other firms supplying items used in the B-58 programme.

Before it flew, many of the B-58's sub-systems were flight tested in a fleet of two B-36's, three C-131B's, an F-89, F-86 and B-47.

The first prototype flew for the first time on November 11, 1956, and this



The first prototype Convair B-58 Hustler Delta-wing Bomber (four General Electric J79 turbojet engines).

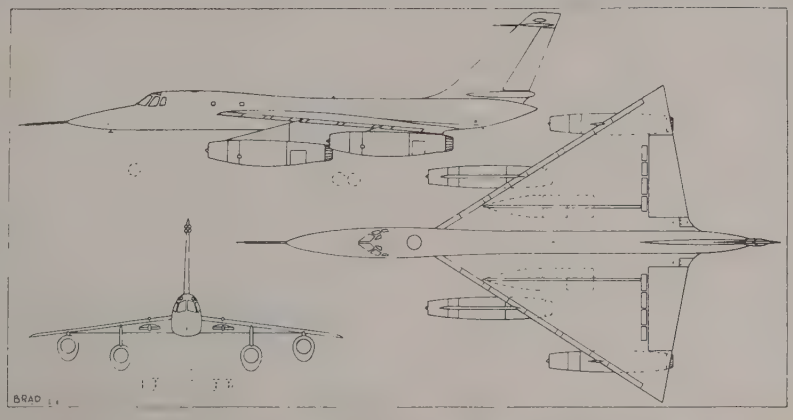


The first prototype Convair B-58 Hustler Delta-wing Supersonic Bomber.

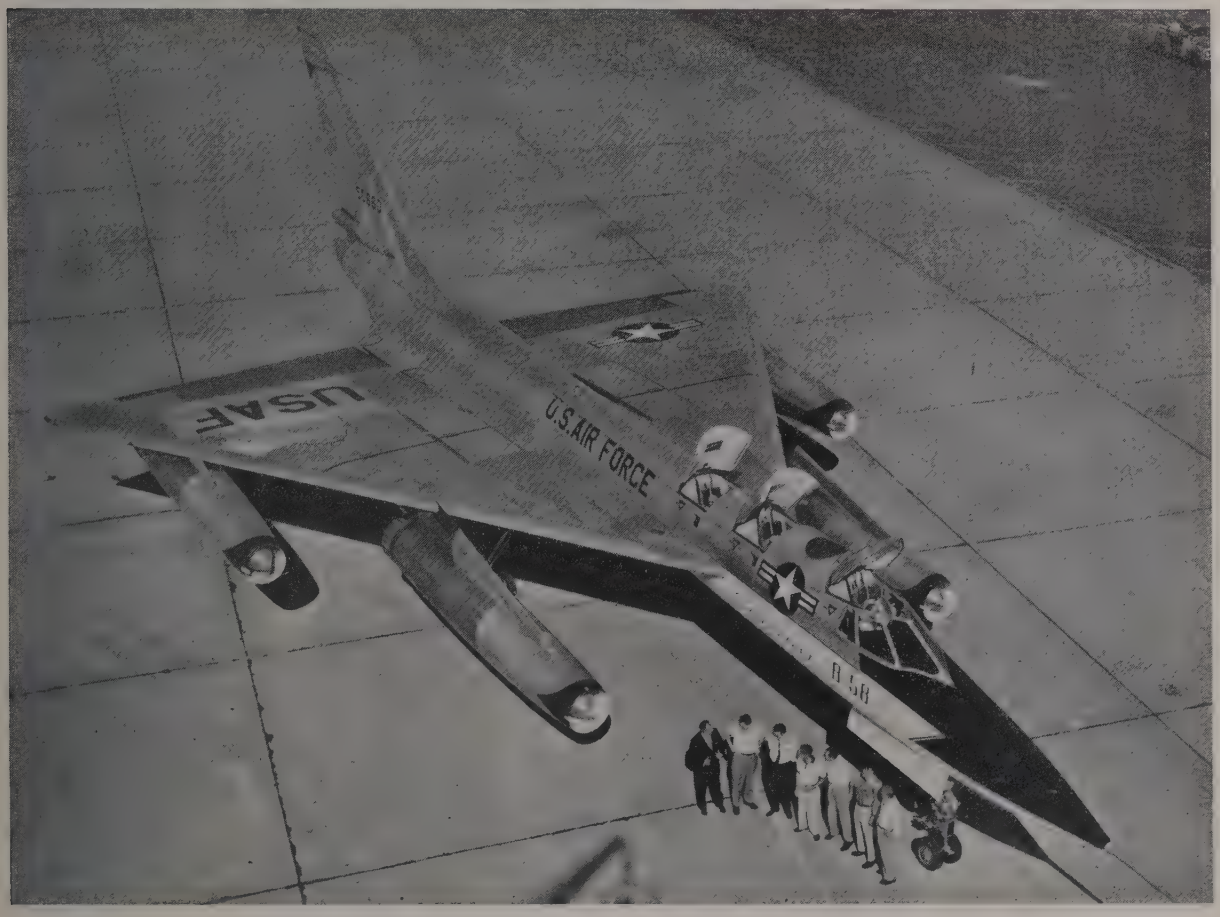
aircraft had completed 51½ hours' flying in 17 flights by February, 1957. The second prototype, first flown in February, 1957, has been fitted with the detachable streamlined under-fuselage pod which is part of the weapons system and can house alternative military loads. These are reported to include air-to-ground nuclear weapons, both guided and unguided; reconnaissance equipment; electronic countermeasures installations and interception equipment.

A third B-58 airframe was flown under the bomb-bay of a Convair B-36 to Wright-Patterson Air Force Base for structural testing in the Spring of 1957.

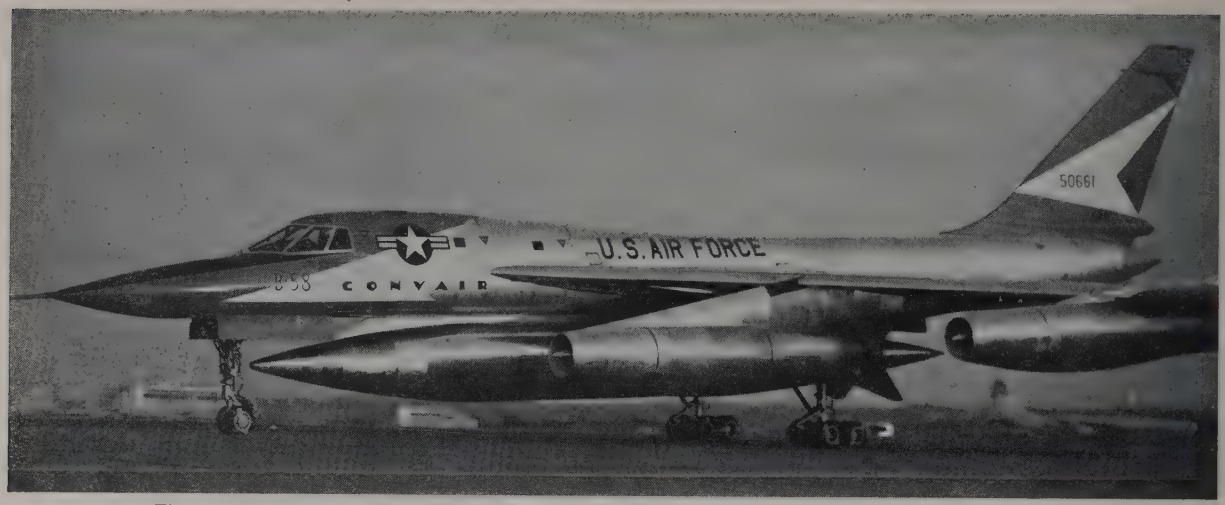
The B-58 is powered by four General Electric J79 turbojets in underwing pods, and carries a crew of three in separate tandem cockpits in the fuselage nose. Its thin delta wings have conical-camber leading-edges. Control surfaces include



The Convair B-58 Hustler Delta-wing Supersonic Bomber.



Another view of the first prototype Convair B-58 Hustler Delta-wing Bomber.



The second prototype Convair B-58 Hustler here seen with its under-fuselage weapons pod.

wide-chord elevons from the wing-root fairings to the outboard engine pods, with spoilers immediately forward of the elevons and small trim tabs inboard of them. Each main landing gear unit has an eight-wheel bogie and the nose-gear is a twin-wheel unit. A large ribbon braking parachute is housed under the tail end of the fuselage.

An initial U.S.A.F. contract for a service test batch of 13 B-58's was followed in the Spring of 1957 by an order for a production batch of 18 of these aircraft. All will be built at Convair's Fort Worth plant.

It was reported in September, 1957 that when General Power, Chief of the U.S.A.F. Strategic Air Command, flew in a B-58, it attained Mach 2.09 (equivalent to 1,380 m.p.h. = 2,220 km.h.) at 50,000 ft. (15,250 m.) and flew above Mach 1.0 for 30 minutes.

DIMENSIONS.—
Span 57 ft. (17.37 m.).
Length 97 ft. (29.57 m.).
Height 31 ft. (9.45 m.).

THE CONVAIR B-36.

Production of the B-36 ceased in August, 1954, and, after a life of eleven years, it was declared obsolete in 1957. 382 were built. Ninety-five have already been scrapped and a further 105 were due to be reduced to produce by the Spring of 1958.

A full description of all the many versions of this notable aircraft, which had a designed range of 10,000 miles (16,000 km.) carrying a 10,000-lb. (4,540-kg.) bomb load, and was the last piston-engined bomber (albeit with turbojet boost) to serve in the U.S.A.F., has appeared in previous editions of "All the World's Aircraft."

THE CONVAIR 880.

First announced in April, 1956, the Convair 880 (originally Skylark 600) is a four-jet transport aircraft for medium range routes. Production 880's are offered for delivery in 1959.

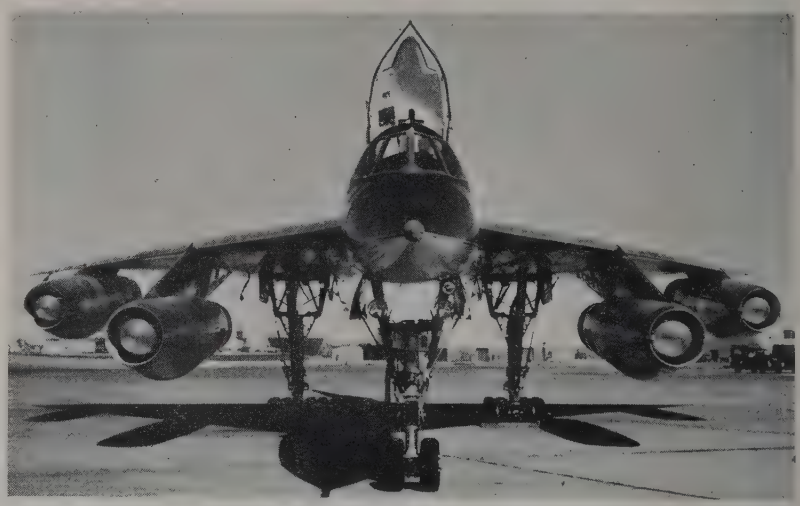
First orders for the 880 were from T.W.A. (30) and Delta Air Lines (10), followed by orders for four from Transcontinental S.A. (Argentine) and four from REAL (Brazil) in 1957.

TYPE.—Medium-range jet-powered Airliner.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 7.0. Sweepback on leading-edge 35°. Manually-operated ailerons are linked with hydraulically-operated spoilers through "mixing box." Wing area 2,000 sq. ft. (185.8 m.²).

FUSELAGE.—Circular-section all-metal structure.

TAIL UNIT.—Cantilever monoplane type with 35° sweepback on all leading-edges. Moderate dihedral on tailplane. Hydraulically-operated variable-incidence tailplane. Rudder and elevators controlled manually through servo tabs.



A front view of the Convair B-58 Hustler.

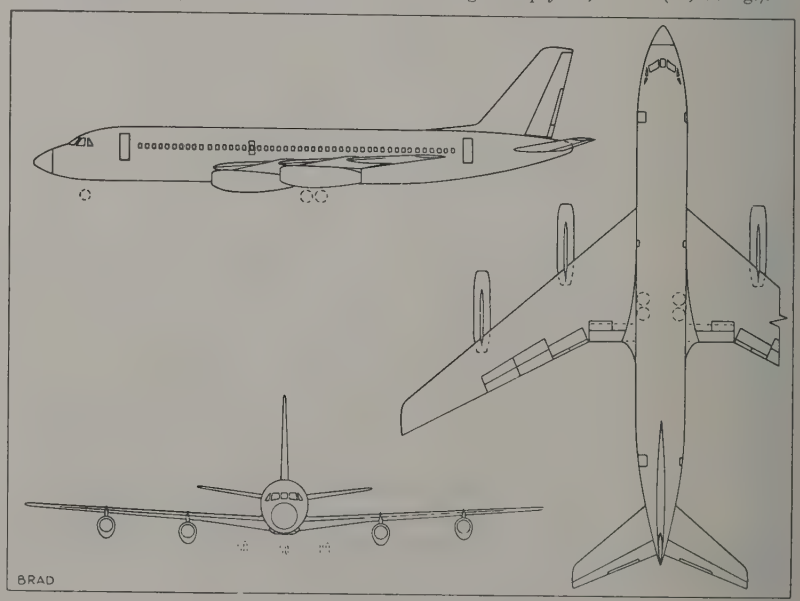
LANDING GEAR.—Retractable tricycle type. Main gear has four-wheel bogie units. Nose gear has twin wheels.

POWER PLANT.—Four General Electric CJ-805-1 turbojet engines of approximately 10,000 lb. (4,536 kg.) s.t. each, on forward-inclined cantilever struts under wing leading-edges. Total fuel capacity 10,770 U.S. gallons (40,768 litres).

ACCOMMODATION.—Crew of 5 and seats for 80 first-class or up to 108 tourist class passengers. Cabin is 89 ft. 3 in. long, 10 ft. 8 in. wide (maximum) and 7 ft. 1 in. high (maximum) (27.2 × 3.25 × 2.15 m.). Cargo compartments (2) with total capacity of 850 cub. ft. (24 m.³).

DIMENSIONS.—
Span 120 ft. (36.58 m.).
Length 124 ft. 2 in. (37.86 m.).
Height 37 ft. 4 in. (11.38 m.).

WEIGHTS (Estimated).—
Weight empty 80,800 lb. (36,670 kg.).



The Convair 880 Four-jet Airliner.



The Convair 440 Metropolitan Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CB-16 engines).

Max. weight loaded 178,500 lb. (80,965 kg.).
Wing loading 89.25 lb./sq. ft. (435.8 kg./m.²).

PERFORMANCE (Estimated).—
Max. cruising speed at 25,000 ft. (7,620 m.). 615 m.p.h. (990 km.h.).
Recommended continuous cruising speed (90% max. cruise power) at 25,000 ft. (7,620 m.) and 135,000 lb. (61,235 kg.) 583 m.p.h. (938 km.h.).
Balanced field length (I.S.A. at max take-off weight) 7,150 ft. (2,180 m.).
Landing distance from 50 ft. (15.25 m.) 3,500 ft. (1,065 m.).
Range with max. fuel in still air with 22,680 lb. (10,287 kg.) payload at 493 m.p.h. (793 km.h.) mean at 35,000 ft. (10,670 m.) mean, no allowances 4,350 miles (7,000 km.).
Range with max. payload in still air, no reserves, 3,960 miles (6,383 km.).

THE CONVAIR 440 METROPOLITAN.

The Model 440 is a development of the 340 with modifications to increase speed (by about 5 m.p.h.=8 km.h.) and to reduce the noise level in the cabin. To improve performance the engine cowling, baffles and the "aspirated cooling" exhaust have been re-designed and aileron and flap seals have been fitted.

The cabin is provided with improved sound-proofing and, in addition, special inner window assemblies have been installed for the first eight rows of seats as an additional means to suppress engine, propeller and exhaust noise.

The Model 440 is offered with either Pratt & Whitney R-2800-CB-16 or CB-17 engines and in 44 and 52 seat versions.

Special kits are available for converting Model 340's up to 440 standard. All K.L.M.'s 340's have thus been modified.

One 440 has been re-engined with two Napier Eland turboprop engines by Pacific Aeromotive Engineering Corpn. for D. Napier and Son, who are offering Eland conversion kits to operators of Convair Model 340 and 440 aircraft.

Optional equipment includes a weather-detection radar nose.

At the time of closing for press orders for a total of 154 Model 440's had been received from REAL (Brazil) (10), Continental Air Lines (3), SAS (16), Aero O/Y (Finland) (3), Sabena (12), Swissair (12), National Airlines (6), Braniff International Airways (5), Delta Air Lines (8), Eastern Air Lines (20), Alitalia (2), Iberia (5), Jugoslovenski Aerotransport (2), Karhumaki Airways (Finland) (2), Ansett Airways (7), Cruzeiro do Sul (Brazil) (4), Republic of Indonesia (3), Deutsche Lufthansa (5), Air Carrier Corp. (Japan) (3), Garuda Indonesian Airways (3), U.S. Air Force (6), Royal Australian Air Force (2), Italian Air Force (1) and private customers (14).

The prototype Model 440 flew on October 6, 1955, followed by the first production aircraft on December 15, 1955.

TYPE.—Twin-engined medium-range Airliner.

WINGS.—Low-wing cantilever monoplane. All-metal structure with stressed-skin covering. Thermal anti-icing. NACA 63.4-120. Wing section. Aspect ratio 12. Chord (mean) 9 ft. 6.3 in. (2.90 m.). Dihedral 4° 50′ on centre wings; 6° 30′ on outer wings. Incidence 4°. All-metal aluminium alloy ailerons and Fowler flaps. Area of ailerons 43.82 sq. ft. (4.07 m.²). Wing area 963.82 sq. ft. (89.54 m.²).

FUSELAGE.—Circular-section aluminium alloy structure with stressed skin covering.

TAIL UNIT.—Cantilever monoplane type. Aluminium alloy structure. Rudder and elevators fitted with trim and servo-control tabs. Thermal anti-icing for leading-edges of fin and tailplane.

LANDING GEAR.—Retractable tricycle type. All three units fitted with twin wheels. Steerable nose-wheel. Oleo-pneumatic shock-absorber struts. Wheel track 25 ft. (7.62 m.).

POWER PLANT.—Two Pratt & Whitney R-2800-CB-16 eighteen-cylinder radial air-cooled engines, each rated at 1,800 h.p. at 8,500 ft. (2,590 m.) in low blower and 1,700 h.p. at 14,500 ft. (4,240 m.) in high blower, and with 2,400 h.p. available for take-off, with water injection, or two Pratt & Whitney R-2800-CB-17 engines, each rated at 1,900 h.p. at 7,000 ft. (2,135 m.) in low blower and 1,750 h.p. at 13,500 ft. (4,115 m.) in high blower, and with 2,500 h.p. available for take-off, with water injection. Three-blade Hamilton Standard Hydromatic automatic fully-feathering and reversing airscrews, diameter 13 ft. 6 in. (4.11 m.). Integral fuel tanks outboard of engine nacelles, with maximum capacity of 1,730 U.S. gallons (6,548 litres). Oil capacity 60 U.S. gallons (227 litres).

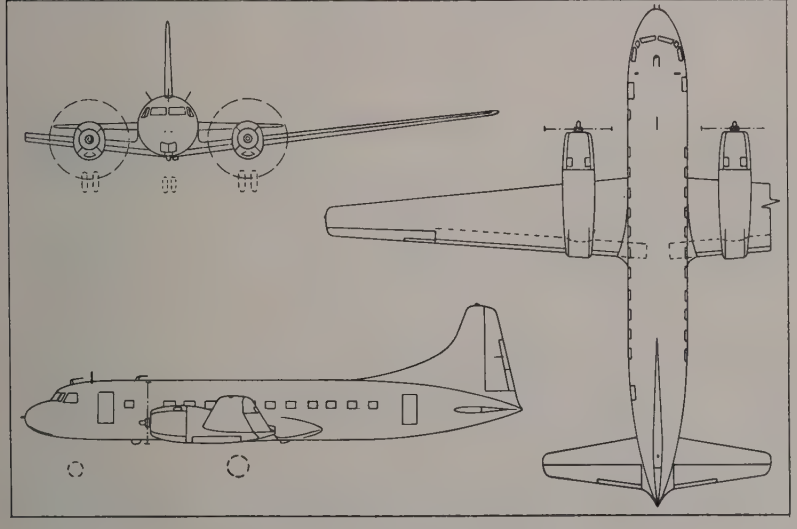
ACCOMMODATION.—Crew of three/four. Cabin seats 44 or 52 passengers in pairs on each side of a central aisle. Integral self-contained stairway located forward of wings on port side. Cabin is pressurised, with radiant-wall heating and refrigeration to maintain a constant cabin temperature in the air and on the ground. Cargo compartments fore and aft of cabin and below cabin floor forward of wings.

DIMENSIONS.—
Span 105 ft. 4 in. (32.12 m.).
Length 79 ft. 2 in. (24.14 m.).
Height 28 ft. 2 in. (8.59 m.).

WEIGHTS AND LOADINGS (CB-16 engines).—
Weight empty 31,305 lb. (14,199 kg.).
Max. take-off weight 48,000 lb. (21,772 kg.).
Max. landing weight 47,650 lb. (21,614 kg.).
Max. wing loading 52.1 lb./sq. ft. (254.3 kg./m.²).
Max. power loading 10 lb./h.p. (4.54 kg./h.p.).

WEIGHTS AND LOADINGS (CB-17 engines).—
Weight empty 31,305 lb. (14,199 kg.).
Max. take-off weight 49,100 lb. (22,271 kg.).
Max. landing weight 47,650 lb. (21,614 kg.).
Max. wing loading 53.3 lb./sq. ft. (260.2 kg./m.²).
Max. power loading 9.82 lb./h.p. (4.45 kg./h.p.).

PERFORMANCE (CB-16 engines).—
Max. speed 309 m.p.h. (497 km.h.).
Average cruising speed (1,200 h.p. per engine) at 20,000 ft. (6,100 m.) and A.U.W. of 45,000 lb. (20,412 kg.) 289 m.p.h. (465 km.h.).
Stalling speed at 46,500 lb. (21,092 kg.) A.U.W. 85 m.p.h. (137 km.h.).
Range with 1,500 lb. (680 kg.) fuel reserve, 1,200 h.p. per engine, zero wind, 45,000 lb. (20,412 kg.) A.U.W., at 20,000 ft. (6,100 m.) 1,040 miles (1,674 km.).
Rate of climb at S/L. 1,192 ft./min. (363 m./min.).
Service ceiling 25,500 ft. (7,770 m.).
Max. CAR operating height with one engine inoperative at 45,000 lb. (20,412 kg.) A.U.W. 9,500 ft. (2,895 m.).
Required CAR runway length for T.O. at S/L. at max. T.O. weight 4,930 ft. (1,503 m.).
Required CAR runway length for landing at S/L. at 46,500 lb. (21,092 kg.) A.U.W. 3,980 ft. (1,213 m.).



The Convair 440 Metropolitan Airliner.



The Convair 440 Metropolitan Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CB-16 engines).

PERFORMANCE (CB-17 engines).—
Max. speed 310 m.p.h. (499 km.h.).
Average cruising speed (1,200 h.p. per engine) at 20,000 ft. (6,100 m.) and A.U.W. of 45,000 lb. (20,412 kg.) 289 m.p.h. (465 km.h.).
Stalling speed at 46,500 lb. (21,092 kg.) weight 85 m.p.h. (137 km.h.).
Range with 1,500 lb. (680 kg.) fuel reserve, 1,200 h.p. per engine, zero wind, 45,000 lb. (20,412 kg.) A.U.W., at 20,000 ft. (6,100 m.) 1,300 miles (2,092 km.).
Rate of climb at S/L. 1,260 ft./min. (384 m./min.).
Service ceiling 24,900 ft. (7,590 m.).
Max. CAR operating height with one engine inoperative at 45,000 lb. (20,412 kg.) A.U.W. 9,500 ft. (2,895 m.).
Required CAR runway length for T.O. at S/L. at max. T.O. weight 5,000 ft. (1,525 m.).
Required CAR runway length for landing at S/L. at 46,800 lb. (21,228 kg.) A.U.W. 4,010 ft. (1,222 m.).

THE CONVAIR-LINER 340.

Although based on the Model 240, the Convair-Liner 340 is largely a new aircraft with greater wing span and area, a longer fuselage, more powerful engines, greater all-up weight and many interior design improvements.

The fuselage of the 340 is the same diameter as that of the 240 but is 54 in. (1.37 m.) longer, achieved by inserting a 16 in. (0.40 m.) section forward and a 38 in. (0.96 m.) section aft of the wings. This extra length permits the introduction of four additional seats, or it can be used for cargo purposes.

The first Convair 340 flew on October 5, 1951, and the first delivery to an airline—United Air Lines—was made on March 28, 1952.

Among the civil users of the Convair-Liner 340 are United Air Lines, Braniff Airways, Delta Air Lines, Continental Air Lines, National Airlines, Hawaiian Airlines, Aramco, Garuda Indonesian Airways, Finnish Air Lines (Aero O/Y), Philippine Air Lines, K.L.M., Aeronaves de Mexico, Cia. Mexicana de Aviacion, Avensa (Venezuela), Jugoslovenski Aerotransport (JAT), Servicos Aereos Cruzeiro do Sul (Brazil), Alitalia, REAL (Brazil), Lufthansa, Saudi Arabian Airlines, The Texas Company, Phillips Petroleum Company, Pratt & Whitney Aircraft, Union Oil Company, Union Carbide Company and Union Producing Company.

The last two Convair 340's built as civil aircraft were delivered to REAL (Brazil) in January, 1955, bringing the total number built to 209.

In April, 1955 it was announced that Saudi Arabian Airlines had ordered a further six Convair 340's This order was met from the C-131D production line, the U.S.A.F. having agreed to release six partly-finished airframes for this purpose.

One Model 340 has been re-engined with two Napier Eland turboprops by D. Napier and Son, who are offering Eland conversion kits to operators of Convair-Liner 340 and 440 aircraft. REAL (Brazil) have signed a contract for the conversion of three of their Model 340's to Eland power.

A full structural description of the Convair-Liner 340 has appeared in previous editions of "All the World's Aircraft."

TYPE.—Twin-engined medium-range Airliner.

POWER PLANT.—Two Pratt & Whitney R-2800-CB16 eighteen-cylinder radial air-cooled engines, each rated at 1,800 h.p. at 8,500 ft. (2,590 m.) in low blower and 1,700 h.p. at 14,500 ft. (4,240 m.) in high blower and with 2,400 h.p. available for take-off (with water injection). Engines mounted in aerodynamically-clean nacelles incorporating what is known as "aspirated cooling." Air after passing through cylinder blocks enters a venturi section into which the exhaust gases are also ejected, the effect being to increase flow of cooling air. Air/exhaust mixture in a ratio of about 5/1 is ejected via twin tail-pipes above rear end of nacelle. Exhaust gas augmentation is claimed to give an increase in speed of about 10-12 m.p.h. (16-19.2 km.h.). Hamilton Standard Hydromatic constant-speed feathering and reversing airscrews. diameter 13 ft. 1 in. (4 m.). Integral fuel tanks outboard of engine nacelles. Maximum fuel capacity 1,750 U.S. gallons (6,615 litres). Provision for underwing refuelling.

ACCOMMODATION.—Crew of three/four. Cabin seats forty-four passengers in pairs on each side of central aisle.

DIMENSIONS.—
Span 105 ft. 4 in. (32.12 m.).
Length 79 ft. 2 in. (24.14 m.).
Height (over tail) 28 ft. 2 in. (8.59 m.).
Wing area 920 sq. ft. (85.5 m.^{2}).

WEIGHTS AND LOADINGS.—
Weight empty 29,486 lb. (13,382 kg.).
Max. gross take-off weight 47,000 lb. (21,320 kg.).
Max. landing weight 46,000 lb. (20,884 kg.).
Max. T.O. wing loading 51.08 lb./sq. ft. (249.27 kg./m.^{2}).
Max. T.O. power loading 9.8 lb./h.p. (4.44 kg./h.p.).

PERFORMANCE.—
Cruising speed (1,200 h.p. per engine) at 18,000 ft. (5,490 m.) 284 m.p.h. (448 km.h.).
Range with 200 miles (320 km.) plus ¾-hour reserve; 1,200 h.p. per engine; 10 m.p.h. (16 km.h.) head wind; 44 passengers and baggage; 1,157 U.S. gallons (4,373 litres) of fuel 2,015 miles (3,225 km.).
Max. CAR operating height with one engine inoperative 9,000 ft. (2,745 m.).
Required CAR runway length for T.O. at max. T.O. weight 4,675 ft. (1,425 m.).
Required CAR runway length for landing S/L. at max. landing weight 4,500 ft. (1,370 m.).

THE CONVAIR-LINER 240.

The Convair-Liner 240 was the first post-war commercial transport designed by Consolidated Vultee and was evolved primarily to serve as a DC-3 replacement. The prototype first flew at San Diego on March 16, 1947, and the first licenced aircraft was delivered to American Airlines on February 28, 1948.

Altogether, 176 Convair-Liner 240's were built, most of which were delivered to, and are still in service with, the following airlines :—American Airlines; Western Air Lines; Pan American World Airways; Canadian Pacific Air Lines; Linee Aeree Italiane (LAI); K.L.M. (Royal Dutch Airlines); Trans-Australia Airlines; Aerolineas Argentinas; Orient Airways (Pakistan); Mohawk Airlines; Sabena (Belgian Airlines); Northeast Airlines; Garuda Indonesian Airways, Ethiopian Airlines, Trans-Ocean Airlines, Civil Air Transport, Inc., Eagle Aviation, Ltd., Iranian Airways, Trans-Arabian and VARIG.

A full structural description of the 240 Convair-Liner has been published in previous editions of "All the World's Aircraft."

TYPE.—Twin-engined medium-range Airliner.

POWER PLANT.—Two Pratt & Whitney R-2800-CA18 eighteen-cylinder radial air-cooled engine rated at 1,900 h.p. at 4,000 ft. (1,220 m.) in low blower and 1,675 h.p. at 13,500 ft. (4,120 m.) in high blower and with 2,400 h.p. available for take-off (with water injection). Either Hamilton Standard Hydromatic or Curtiss Electric constant-speed feathering and reversing airscrews, diameter 13 ft. 1 in. (4 m.). Integral fuel tanks outboard of engine nacelles. Maximum fuel capacity 1,550 U.S. gallons (5,860 litres).

ACCOMMODATION.—Crew of three/four. Cabin seats forty (40) passengers in pairs on each side of central aisle.

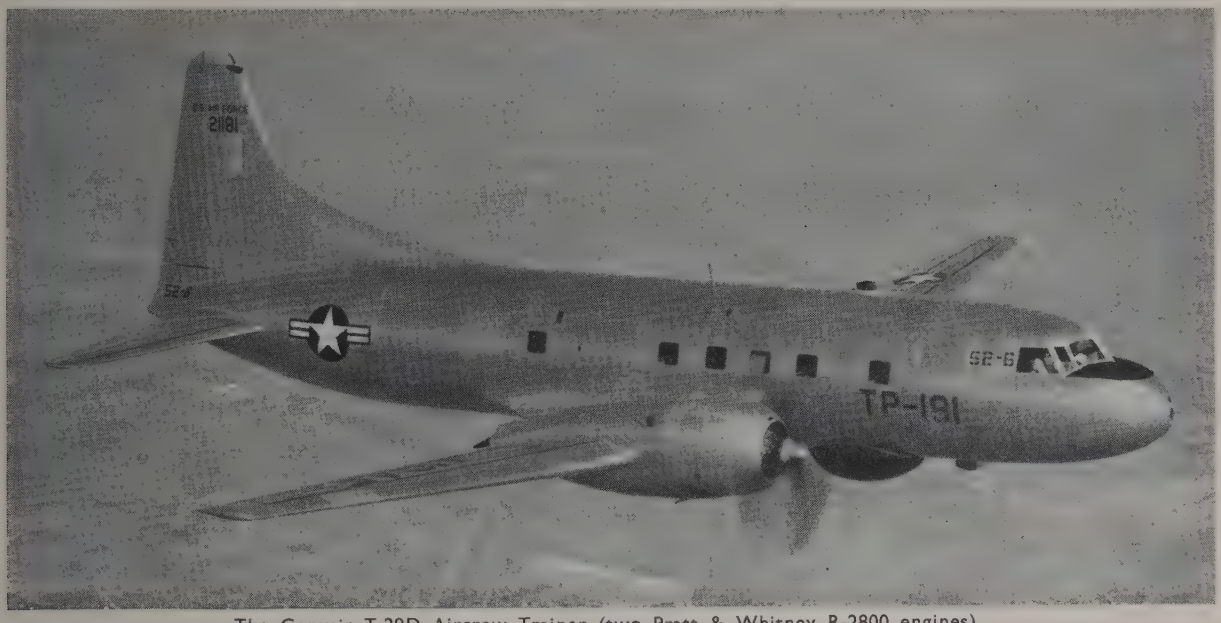
DIMENSIONS.—
Span 91 ft. 9 in. (27.98 m.).
Length 74 ft. 8 in. (22.77 m.).
Height 26 ft. 11 in. (8.22 m.).

WEIGHTS AND LOADINGS.—
Weight empty 27,600 lb. (12,530 kg.).
Payload 9,350 lb. (4,245 kg.).
Weight loaded 41,790 lb. (18,972 kg.).
Landing weight 39,800 lb. (18,070 kg.).
Wing loading (T.O.) 51.2 lb./sq. ft. (249.8 kg./m.^{2}).
Power loading (T.O.) 8.7 lb./h.p. (3.95 kg./h.p.).

PERFORMANCE.—
Max. speed 347 m.p.h. (538 km.h.) at 16,000 ft. (4,880 m.).
Cruising speed 270 m.p.h. (432 km.h.) at 16,000 ft. (4,880 m.).
Landing speed (full flaps and power off) 88 m.p.h. (140 km.h.).
Service ceiling 30,000 ft. (9,150 m.).
Operational ceiling at 40,000 lb.=17,360 kg. on one engine 8,500 ft. (2,590 m.).
Range (with ATA reserve) at 270 m.p.h. (432 km.h.) cruising speed 1,800 miles (2,880 km.).

THE CONVAIR T-29.

In 1948 Convair began the military conversion of the Convair-Liner 240 to serve as an aircrew trainer for the U.S.A.F. under the designation T-29. The following versions of the T-29 have been built :—



The Convair T-29D Aircrew Trainer (two Pratt & Whitney R-2800 engines).

T-29A. Original Convair-Liner 240 crew trainer conversion. Non-pressurised but fitted with oxygen equipment for high-altitude training, permitting 6 hour's duration at 20,000 ft. (6,100 m.) at 250 m.p.h. (400 km.h.). Cabin has fourteen fully-equipped stations for students and one radio operator's station. Each student has access to a map table, Loran scope, altimeter indicator and radio compass panel. In roof of fuselage are four astrodomes. Five drift-meters also included. First T-29A flew on September 22, 1949. All T-29A's later modified with additional outer wing fuel tanks for increased range at operational height. 48 built.

T-29B. Development of T-29A with pressurised cabin, increased fuel capacity and greater A.U.W. of 43,575 lb. (19,780 kg.) compared with 40,500 lb. (18,390 kg.) of T-29A. Major external difference is the fitting of three astrodomes and one periscopic sextant on top of fuselage instead of the four astrodomes of the A Series. First T-29B flew on July 30, 1952. 105 built.

T-29C. Similar to T-29B but fitted with two advanced model 2,500 h.p. Pratt & Whitney R-2800 engines. Accommodation for 14 students and instructors. First T-29C flew on July 28, 1953. About 20 of these aircraft, assigned to the Air Force Academy at Colorado Springs, are being fitted with two wingtip-mounted Fairchild J44 turbojets to provide improved take-off and climb performance at the high-altitude airfields used by the Academy. 119 built.

T-29D. Similar to T-29C but equipped for advanced navigation/bombardment training. Accommodation for six students and two instructors. Training equipment for all phases of radar and optical bombing and navigation, including use of the "K" system bombsight. Only external difference compared with T-29B is the absence of astrodomes. First T-29D flew on August 11, 1953. 93 built.

VT-29E. This designation covers four Convair-Liner 240 personnel transports for MATS use. Two are furnished for V.I.P. use and two have standard high-density seating.

The following data refers specifically to the T-29B which is powered with two 2,500 h.p. Pratt & Whitney R-2800-99W engines.

DIMENSIONS.—
Span 91 ft. 9 in. (27.98 m.).
Length 74 ft. 8 in. (22.77 m.).
Height over tail 27 ft. 3 in. (8.31 m.).
Wing area 817 sq. ft. (75.9 m.²).

WEIGHT.—
T.O. weight 43,575 lb. (19,780 kg.).

PERFORMANCE.—
Max. speed 300 m.p.h. (480 km.h.).
Average cruising speed 230 m.p.h. (368 km.h.).
Stalling speed (with flaps) 92 m.p.h. (147 m./min.).
Initial rate of climb 1,370 ft./min. (418 m./min.).
Service ceiling 24,000 ft. (6,320 m.).
Service ceiling on one engine 7,500 ft. (2,290 m.).
T.O. distance to 50 ft. (15.25 m.) 1,030 yds. (945 m.).
Landing distance from 50 ft. (15.25 m). 780 yds. (714 m.).
Cruising range 1,500 miles (2,400 km.).

THE CONVAIR C-131.

The C-131A Samaritan is a military transport version of the Convair-Liner 240. It was the first pressurised twin engined air-evacuation transport to be ordered by the Military Air Transport Service. 26 were built.

The cabin can be arranged to carry 37 passengers in backward-facing seats or 27 stretcher cases, or several combinations of both. For loading stretchers a large hydraulically-operated door, opening upwards, is provided on the port side of the cabin aft of the wings. A standard Convair-Liner integral stairway which folds into the aircraft is located on the starboard side forward of the wings.

The C-131A is powered by two 2,500 h.p. Pratt & Whitney R-2800-99W engines.

DIMENSIONS.—
As for Convair-Liner 240.

WEIGHTS.—
Weight empty 29,000 lb. (13,166 kg.).
Weight loaded 43,575 lb. (19,783 kg.).

PERFORMANCE.—
Max. speed 313 m.p.h. (500 km.h.).
Stalling speed 95.4 m.p.h. (153 km.h.).
Initial rate of climb 1,410 ft./min. (430 m./min.).
Service ceiling 24,500 ft. (7,470 m.).
Service ceiling on one engine 7,100 ft. (2,165 m.).
Range with max. fuel (1,530 U.S. gallons= 5,780 litres) 1,600 miles (2,560 km.).
Take-off distance to 50 ft. (15.25 m.) 1,100 yds. (1,006 m.).



The Convair C-131A Samaritan Transport (two 2,500 h.p. Pratt & Whitney R-2800-99W engines). (*Gordon Williams*).



The Convair YC-131C (two 3,750 s.h.p. Allison YT56 turboprop engines).

Whereas the C-131A previously described is based on the Convair-Liner 240, there are several other aircraft in the C-131 series which are developments of the slightly larger Convair-Liner 340. These are :—

C-131F. This designation is applied to several aircraft which are used as flying laboratories to test electronic equipment, either by the Air Force itself for research projects or by firms engaged in the development of special electronic devices under Air Force contract. The C-131B is pressurised, has the Convair-Liner's integral passenger stairway forward of the wings, and is equipped with fittings to accommodate 48 passenger seats so that the aircraft can be quickly converted for transport duties. Large cargo door on port side of fuselage aft of wings for loading test equipment, etc. Provision for installation of radome beneath fuselage. 36 built.

One C-131B has been fitted with two Solar T41 gas-turbine units, mounted in special plastic and metal pods on pylons, one under each wing. It is the first aircraft to carry externally these units, which drive generators to supply electrical power to the aircraft.

First C-131B flew for the first time on December 1, 1954.

DIMENSIONS.—
Same as for Convair-Liner 340.

WEIGHTS.—
Weight empty 29,000 lb. (13,166 kg.).
Weight loaded 47,000 lb. (21,340 kg.).

PERFORMANCE.—
Max. speed 305 m.p.h. (488 km.h.).
Cruising speed 276 m.p.h. (442 km.h.).
Service ceiling over 20,000 ft. (6,100 m.).
Range with max. fuel 1,900 miles (3,040 km.).

YC-131C. This designation covers two Convair-Liner 340's which are powered by two 3,750 h.p. Allison YT56-A-3 turboprop engines. They have been flown intensively by No. 1700 Test Squadron, as part of the U.S.A.F.'s turboprop test and evaluation programme. The gross weight of the YC-131C is 53,200 lb. (24,153 kg.), and it has an average true air speed of approximately 320 m.p.h. (515 km.h.), cruising at 21,000 ft. (6,400 m.).

The first YC-131C made its maiden flight on June 29, 1954.

VC-131D. Military transport version of the Convair-Liner 340 for use in the Air Force's domestic transport service. 33 built. Last six incorporate modifications for speed improvement and sound reduction introduced in Model 440 (which see).

TC-131E. Ten built as electronic countermeasure trainers for Strategic Air Command. Nine now being converted into air evacuation transports for M.A.T.S. Incorporates sound-proofing and speed improvements introduced in Model 440 (which see). Extruded magnesium floor stressed to 300 lb./sq. ft. 10-foot cargo door on port side aft of wing. Integral passenger stairway.

Five basically-similar C-131E aircraft with special equipment employed by the C.A.A. for testing facilities along the Federal Airways above 10,000 ft. (3,050 m.).

RC-131F. Similar to TC-131E. Six for Military Air Transport Service (MATS).

RC-131G. Similar to RC-131F. One for Military Air Transport Service.

R4Y-1. Cargo / personnel / ambulance version of 340, with two 2,500 h.p. Pratt & Whitney R-2800-52W (Mod.) engines. Thirty-six for U.S. Navy. Reinforced plastic-covered extruded magnesium floor stressed to 300 lb./sq. ft. Tie-down rings in floor to withstand 6,000 lb. strain. 10-foot cargo door on starboard side. Integral passenger stairway. As personnel transport can carry 44 passengers in removable upholstered seats which can face either forward or backward. Seats are interchangeable with those used in R3Y flying-boat transport. Military bucket seats may also be installed. No galley or baggage compartment. Toilet at rear of cabin. As ambulance can carry 27 stretcher patients and as freighter its payload is 12,000 lb. Flight deck similar to 340. First production R4Y-1 flew on June 29, 1955.

R4Y-1Z. This is an executive transport version of the Convair-Liner 340 in service with the U.S. Navy. Seats 24 passengers and sleeps 6, plus crew. Based at the U.S. Naval Air Station, Anacostia.

Structurally, the R4Y-1 and R4Y-1Z are generally similar to the Model 440 (which see). Altogether, 36 were built.

R4Y-2. Two 440's used by the U.S. Navy Bureau of Aeronautics as combined transport and research aircraft.

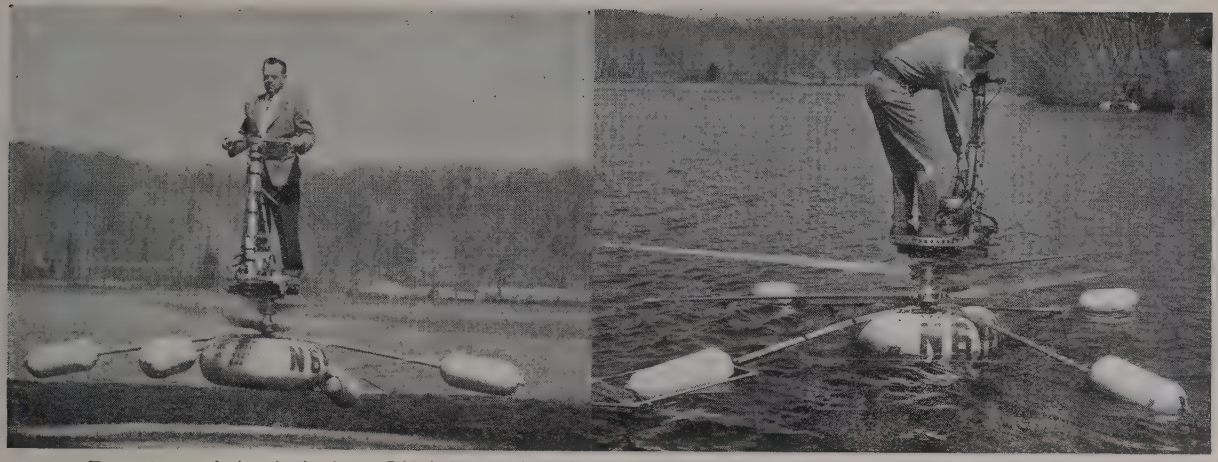
DIMENSIONS.—
Same as for Convair Metropolitan 440.

WEIGHTS.—
Weight empty 30,464 lb. (13,918 kg.).
Weight loaded 47,000 lb. (21,319 kg.).
Landing weight 46,500 lb. (21,092 kg.).

PERFORMANCE.—
Max. speed at 16,000 ft. (4,875 m.) 294 m.p.h. (473 km.h.).
Cruising speed (1,200 h.p. per engine) at 20,000 ft. (6,100 m.) 289 m.p.h. (465 km.h.).
Landing speed 85 m.p.h. (137 km.h.).



The Convair R4Y-1 Naval Transport (two 2,500 h.p. Pratt & Whitney R-2800-52W engines).



Two views of the de Lackner DH-4 Aerocycle. On the right the engine is being started. (*Howard Levy*)

DE LACKNER HELICOPTERS, INC.

HEAD OFFICE: 101, MAIN STREET, MOUNT VERNON, NEW YORK.

President: Donald de Lackner.

de Lackner Helicopters, Inc. is responsible for building the Aerocycle single-place helicopter, seven of which have been built for the U.S. Army, following tests in which soldiers were stated to have learned to control the prototype in 20 minutes.

THE DE LACKNER DH-4 AEROCYCLE.

Originally known as the Heli-Vector, this aircraft made its first free flight on January 22, 1955. It is a single-place helicopter in which the pilot and engine are located on a small platform above a pair of 15-foot (4.5 m.) contra-rotating rotors. Below the rotors on the prototype and first four production models are a central doughnut-type air-bag and four out-rigged stabilising air-bags, which enable the Aerocycle to take-off from and alight on both land and water. The remaining three production models for the U.S. Army have a tubular skid landing gear with a track of 7 ft. 4 in. (2.23 m.).

The Aerocycle is powered by a 43 h.p. Kiekhaefer Mercury Mark 55 two-stroke outboard motor which drives the rotors by means of two Vee belts. An automatic torque-balancing unit and a clutch to permit autorotation are incorporated in the rotor drive. The prototype has already made autorotative tests and is said to have a hovering ceiling of over 5,000 ft. (1,525 m.).

The pilot standing on the platform controls the Aerocycle by leaning his body in the required direction. He is provided with a control column to which he is lightly strapped. The column is topped by a pair of handle-bars the movement of which turns the platform to face in the right direction. A twist-grip control operates the engine throttle.

The hollow control column serves as the fuel tank and has a capacity of 1 U.S. gallon (3.78 litres). Additional fuel can be carried in a 5 U.S. gallon (18.9 litre) auxiliary tank.

The prototype Aerocycle weighs 218 lb. (98.9 kg.) with test equipment, but production versions are estimated at 165 lb. (74.8 kg.). Carrying one person and 125 lb. (56.7 kg.) of cargo, they will have an estimated top speed of 75 m.p.h. (120 km.h.) and range of 15 miles (24 km.) on 1 U.S. gallon of fuel.

DOMAN

DOMAN HELICOPTERS, INC.

HEAD OFFICE AND WORKS: MUNICIPAL AIRPORT, DANBURY, CONNECTICUT.

Established: August 31, 1945.

Vice-President, Engineering and Chairman of the Board: Glidden S. Doman.

Director of Manufacturing: Thomas E. Zeerip.

Director of Research and Development: Stephen du Pont.

Director, Military Contracts Department: John W. Mazur.

Treasurer: Arthur R. Tallardy.

Doman Helicopters, Inc. was formed to develop a helicopter embodying new principles established by its engineers. These include a hingeless rotor unit in which the blades are dynamically flexible but otherwise unarticulated, a hydraulic rotor control system, and a rotor mechanism contained within a housing with circulating oil lubrication provided for all moving parts.

The latest Doman helicoptor, the LZ-5-2, made its first flight on April 27, 1953 and two are undergoing service trials by the U.S. Army Field Forces. C.A.A. certification for the LZ-5-2 was granted on December 30, 1955.

First commercial sales of the LZ-5-2 include ten to Helicondor de Colombia and three to Pittsburgh Airways.

A subsidiary known as Doman-Fleet Helicoptors has been formed by Doman and Fleet Manufacturing, Ltd. of Fort Erie, Ontario, Canada, to manufacture and market the LZ-5-2 helicopter in Canada. The first Canadian-built LZ-5-2 was extensively flown and demonstrated in Canada during 1955. The Model LZ-5-2 was also given type approval by the Department of Transport of the Canadian Government.



The Doman LZ-5-2 Helicopter (400 h.p. Lycoming SO-580 engine).

THE DOMAN LZ-5-2.

U.S. Air Force designation: H-31.

TYPE.—General Purpose Helicopter.

ROTOR SYSTEM.—One four-blade main rotor and one three-blade anti-torque and steering tail rotor. Main rotor of hingeless type, articulation for aerodynamic flapping being provided by gimbal-mounting the hub. The hub is a four-spoked welded component and above hub is a planetary reduction gear assembly. The sun gear is splined to the drive shaft, the ring gear is secured to the non-rotating gimbal ring and the planet carrier is attached to the rotor hub. A common housing encloses the reduction gearing, swashplate and rotor mechanism, with lubrication by circulating oil. Each blade has a spar of plastic-bonded birch laminates and a plastic-bonded mahogany ply covering. Entire leading-edge is armoured with nylon and the trailing-edge is of extruded nylon which serves as a trim-tab. Near the root the bending and torsion loads of the laminated spar are transferred to a tubular steel spar, the root of which is secured in the hub housing by a bearing pack similar to airscrew practice. Main rotor blade area (each) 18.4 sq. ft. (1.71 m.²). Total disc area 1,810 sq. ft. (168.2 m.²). Anti-torque rotor blades rigidly attached to gimbal-mounted hub. Total disc area of anti-torque rotor 78.5 sq. ft. (7.29 m.²).

FUSELAGE.—Welded steel-tube structure covered with magnesium and aluminium sheet.

LANDING GEAR.—Four-wheel type. Cleveland Pneumatic air-oil shock absorbers. Goodyear wheel sand tyres, size 10.00 SO and 5.00-5. Tyre pressure 65 lb./sq. in. 4.57 kg./cm.²). Track 7 ft. 6 in. (2.29 m.). Wheelbase 7 ft. 9 in. (2.35 m.). Alternatively, pontoons or skids can be fitted.

POWER PLANT.—One 400 h.p. Lycoming SO-580-A1B eight-cylinder horizontally-opposed air-cooled engine mounted in nose of fuselage with crankshaft centre-line inclined up and aft at 32 degrees. Fluid drive with mechanical lock-up on engine crankshaft flange coupled to inclined tubular drive shaft equipped with universal joints. Tail rotor drive from take-off

gear in main rotor. Main rotor/engine r.p.m. ratio 14.42 : 1. Anti-torque rotor/engine r.p.m. ratio 3.154 : 1. Fuel tankage in floor beam structure of main cabin section. Total fuel capacity 119 U.S. gallons (450 litres). Oil capacity 8 U.S. gallons (30.2 litres).

ACCOMMODATION.—Pilot's compartment in nose above engine seating two side-by-side. Cabin may seat up to six or accommodate four stretchers. Seats are quickly-removable for freight-carrying. For certain bulk cargo operation such as crop-dusting and pipe-carrying, the fuselage covering and other non-structural parts may be removed to permit a useful load of 2,250 lb. (1,020 kg.) to be carried, within the C.A.A. certificated A.U.W. of 5,200 lb. (2,360 kg.). Cabin is 7 ft. 1 in. (2.16 m.) long, 5 ft. (1.52 m.) wide and 5 ft. 11 in. (1.82 m.) high. Non-structural windowed accordian doors of cabin easily detachable for loading bulky objects, giving a 7 ft. 1 in. (2.16 m.) wide access to the cabin.

DIMENSIONS.—
Main rotor diameter 48 ft. (14.64 m.).
Length of fuselage 37 ft. 10 in. (11.54 m.).
Overall width 5 ft. (1.52 m.).
Height (to top of rotor pylon) 10 ft. 5 in. (3.17 m.).
Anti-torque rotor diameter 10 ft. (3.05 m.)

WEIGHTS.—
Weight empty 3,250 lb. (1,475 kg.).
Disposable load 1,950 lb. (885 kg.).
Weight loaded 5,200 lb. (2,360 kg.).

WEIGHTS (stripped configuration).—
Weight empty 2,950 lb. (1,336 kg.).
Disposable load 2,250 lb. (1,020 kg.).
Weight loaded 5,200 lb. (2,360 kg.).

PERFORMANCE (at 5,200 lb.=2,360 kg. A.U.W.).—
Max. speed 104 m.p.h. (166.4 km.h.).
Cruising speed 81 m.p.h. (130 km.h.).
Max. rate of climb 850 ft./min. (285 m./min.).
Hovering ceiling (in ground effect) 4,000 ft. (1,216 m.).
Service ceiling 11,500 ft. (3,496 m.).
Retrieving radius for two stretcher patients 240 miles (384 km.).
Max. endurance 3.7 hours.

DOUGLAS

THE DOUGLAS AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: SANTA MONICA, CALIFORNIA.

OTHER WORKS: EL SEGUNDO AND LONG BEACH, CAL, AND TULSA, OKLAHOMA.

Established: 1920. (Reorganized: 1928).

Chairman: Donald W. Douglas.

President: Donald W. Douglas, Jr.

Vice-Chairman: Frederick W. Conant.

Vice-President—Engineering: A. E. Raymond.

Vice-President—Commercial Sales: Nat Paschall.

Vice-President—General Administration: John A. Dundas.

Vice-President—Public Relations: A. M. Rochlen.

Vice-President—Long Beach Division: K. G. Farrar,

Vice-President—Santa Monica Division: L. A. Carter.

Vice-President—El Segundo Division: H. G. Hynd.

Vice-President and Director, European Division: M. E. Oliveau.

Executive Secretary: G. B. Gelly.

Treasurer: Harry W. Strangman.

SANTA MONICA DIVISION.
General Manager: L. A. Carter.
Works Manager: H. W. Thue.
Chief Engineer: E. F. Burton.

EL SEGUNDO DIVISION.
General Manager: H. G. Hynd.
Works Manager: R. A. Myers.
Chief Engineer: E. H. Heinemann.

LONG BEACH DIVISION.
General Manager: K. G. Farrar.
Works Manager: W. A. Burton.
Chief Engineer: Carlos C. Wood.

TULSA DIVISION.
Works Manager: J. L. Jones.
Chief Engineer: D. E. Dunlap.

CHARLOTTE DIVISION.
General Manager: S. P. Smith.
Works Manager: J. P. Rogan.
Engineering Manager: A. D. Jamtaas.

The Douglas Aircraft Company has occupied the present factory site at Clover Field, Santa Monica, Cal., since 1928. It also operates plants at El Segundo, nine miles from the main plant, at Long Beach, 25 miles away, and at Tulsa, Oklahoma.

The Santa Monica Division is responsible for the production of the DC-6 and DC-7, all current production versions of which are being manufactured on the same assembly lines. By mid-1957 a total of 870 commercial transports in the DC-6/DC-7 series had been sold to 23 American and 26 international operators since the first DC-6 went into service in 1947. In addition, 168 of the military version of the DC-6 (C-118 and R6D-1) were delivered to the U.S.A.F. and U.S. Navy before production ceased in December, 1955. At the time of writing (31-7-57) 43 DC-7C's, 81 DC-7's, 48 DC-6B's and 34 DC-6A's were still to be delivered.

The El Segundo Division continues to manufacture the A3D Skywarrior, the F4D Skyray, and A4D Skyhawk. Production of the AD-7 Skyraider ended in February, 1957.

The Long Beach Division is responsible for the production of the B-66B and RB-66B for the U.S.A.F. Long Beach is also handling production of the C-133A transport, the first of which made its maiden flight on April 23, 1956.

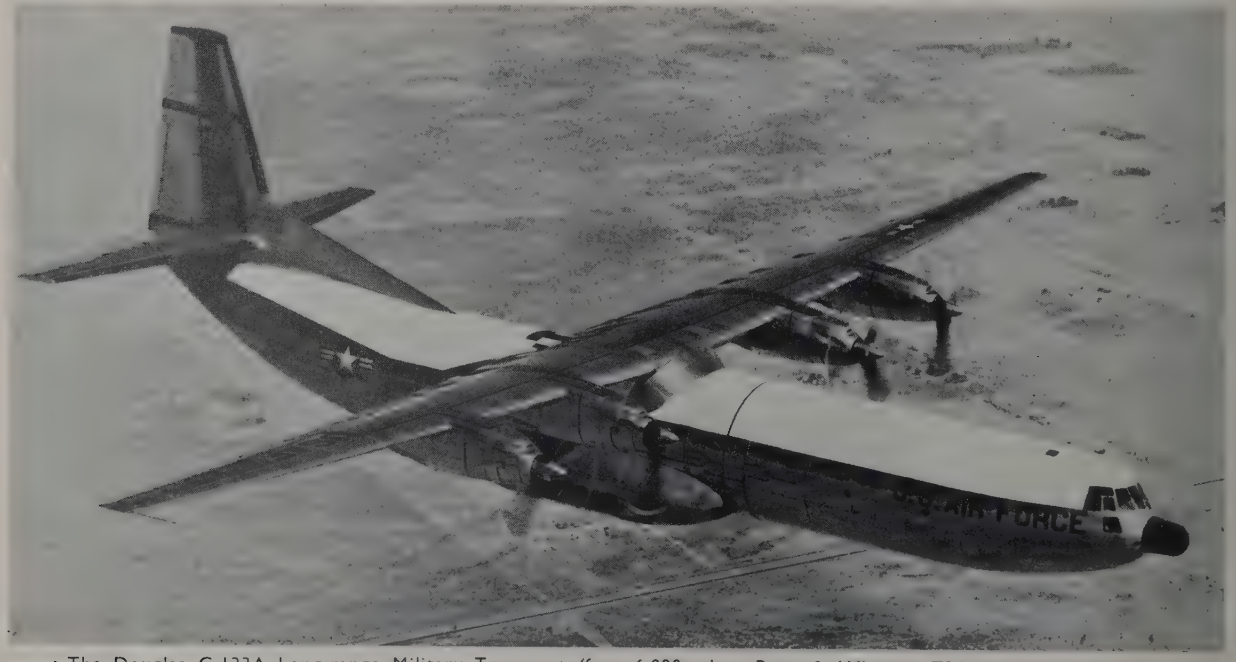
The Tulsa Division, a war-time bomber plant, was re-activated in 1951 to assist in the three-company production programme for the Boeing B-47 bomber. This work was completed in December, 1956 and the Tulsa Division is now producing a total of 55 RB-66C's and WB-66D's for the U.S.A.F.

The Douglas company is engaged on an extensive programme of development which includes conventional military aircraft of advanced design, guided missiles, rockets, etc.

In the missile field, the Santa Monica factory is producing the Nike surface-to-air anti-aircraft rocket and the Honest John free-flight surface-to-surface rocket missile for the Army Field Forces, and is developing the Thor intermediate-range ballistic missile and the MB-1 Genie nuclear air-to-air missile for the U.S.A.F. The Charlotte plant, formerly an Army ordnance depot and now being operated by Douglas, serves as a secondary source in the production of the Nike, America's first operational guided missile. All these weapons are described in the "Guided Missiles" section of this work.

THE DOUGLAS C-133A.

The C-133A is a four-engined transport which, although not very much bigger in overall dimensions than the C-124, can carry payloads equivalent to twice the normal cargo capacity of the C-124 Globemaster II. Detailed design work on the aircraft began in February, 1953. The first C-133A was completed in February, and made its first flight on April 23, 1956. By the end of January, 1957, three C-133A's had been delivered



The Douglas C-133A Long-range Military Transport (four 6,000 e.h.p. Pratt & Whitney T34 turboprop engines).

to Edwards Air Force Base for flight testing and a fourth to Wright-Patterson Air Force Base for climatic tests. The first operational C-133 was delivered on August 29, 1957.

The C-133A is powered by four 6,000 e.h.p. Pratt & Whitney T34-P-3 turboprop engines.

The C-133A's main freight hold is 90 ft. (27.45 m.) long with the floor at truck-bed height. There are two loading doors and virtually all types of military vehicles can be driven up the integral ramp and through the main doors beneath the rear of the fuselage. Typical loads are two prime-movers weighing more than 40,000 lb. (18,160 kg.) each, 16 loaded Jeeps, 20 jet engines or various combinations of vehicles, heavy ordnance and general cargo. Roller conveyors can be installed in existing fittings in the aircraft in approximately five minutes to speed the loading of heavy items of freight.

Although designed primarily for air freight, the basic configuration of the C-133A can easily be modified to permit the transportation of more than 200 fully-armed troops. It can also be used as an ambulance.

TYPE.—Four turboprop-powered Long-Range Transport.

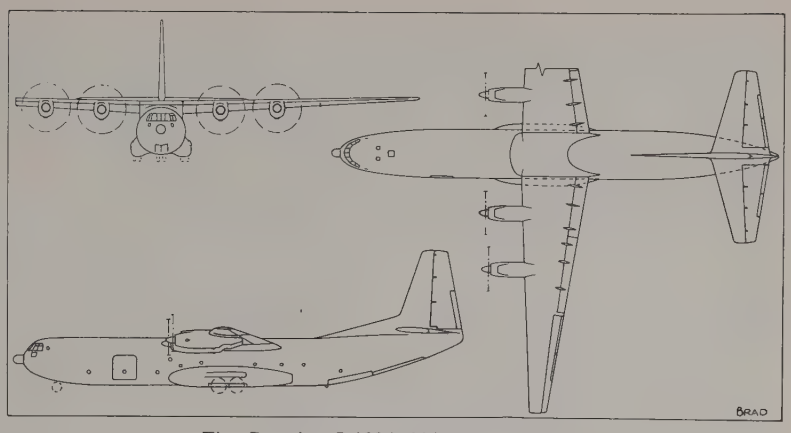
WINGS.—High-wing cantilever monoplane. Chord at tip 5 ft. 6½ in. (1.69 m.). Dihedral 2°. All-metal stressed-skin construction. Double slotted flaps between ailerons and fuselage. Thermal anti-icing system. Vortex generators on upper surfaces forward of ailerons. Total area of ailerons 143.3 sq. ft. (13.31 m.²). Total area of flaps 496.5 sq. ft. (46.13 m.²). Wing area 2,673.1 sq. ft. (248.3 m.²).

FUSELAGE. — All - metal semi - monocoque structure. Crew accommodation and freight hold pressurised to maintain 10,000 ft. (3,050 m.) cabin altitude to 35,000 ft. (10,675 m.).

TAIL UNIT.—Cantilever monoplane type. All-metal stressed-skin structure. Pneumatic boost de-icing system. Areas: fin 353.7 sq. ft. (32.86 m.²), rudder 183 sq. ft. (17.0 m.²), tailplane 459.2 sq. ft. (42.66 m.²), elevators 341.5 sq. ft. (31.73 m.²). Tailplane span 60 ft. (18.29 m.).

LANDING GEAR.—Retractable type. Steerable dual nose-wheel unit. Two main units of four wheels each retract into faired pods on sides of fuselage. Hydraulic actuation. Main tyres 20.00 × 20. Nose tyres 15.00 × 16. Wheel track 20 ft. 1 in. (6.12 m.). Wheelbase 58 ft. 11 in. (17.95 m.).

POWER PLANT.—Four 6,000 e.h.p. Pratt & Whitney T34-P-3 turboprop engines, each driving a Curtiss-Wright Turboelectric three-blade 18 ft. (5.49 m.) constant-speed reversing airscrew. Total fuel capacity 16,500 U.S. gallons (62,370 litres). Single-point pressure refueling system with nozzle adapter in forward portion of starboard landing-gear pod. Engine starting by compressed air supplied by auxiliary gas-turbine installation located in port landing gear pod.



The Douglas C-133A Military Transport.

ACCOMMODATION.—Crew of four, pilot, co-pilot, navigator and systems engineer. Quarters for relief crew of three for extended operating. Usable hold is 90 ft. (27.45 m.) long and constant floor width is 11 ft. 10 in. (3.60 m.). Capacity of hold is 13,000 cub. ft. (368 m.³). Hold floor is 4 ft. 2 in. (1.27 m.) above ground. Loading doors in port side of fuselage forward and at rear of hold beneath fuselage. Main rear loading door in two sections, the lower section forming loading ramp, which is able to support a load of 25,000 lb. (11,340 kg.) in horizontal position and raise from ground with a 10,000 lb. (4,536 kg.) load. Doors, which are hydraulically-operated, are sealed to support full cabin pressure. Vehicles and other prime-movers up to 12 ft. (3.66 m.) high can drive into fuselage through rear door. Forward side door, 8 ft. 4 in. × 8 ft. 10 in. (2.54 m. × 2.69 m.) for direct loading of freight from truck or trailer. Entire accommodation pressurised and heated, the heating system having a capacity of 900,000 B.Th.U's. All pressurisation and ventilating requirements supplied by auxiliary dual gas-turbine power installation in port landing gear pod. Four automatically ejected and inflated life-rafts in centre-section, two on each side of fuselage and accessible from emergency exits. Separate life-raft for crew in forward fuselage.

DIMENSIONS.—
Span 179 ft. 8 in. (54.75 m.).
Length 157 ft. 6½ in. (48.0 m.).
Height 48 ft. 3 in. (14.70 m.).

WEIGHTS.—
Weight empty 111,715 lb. (50,680 kg.).
Weight loaded 255,000 lb. (115,770 kg.).
Overload gross weight 282,000 lb. (127,920 kg.).

PERFORMANCE.—
Range with 50,000 lb. (22,680 kg.) payload 4,030 miles (6,485 km.).
Range with 100,000 lb. (45,360 kg.) payload 1,300 miles (1,930 km.).

THE DOUGLAS GLOBEMASTER II.

U.S.A.F. designation: C-124.

The Globemaster II transport has the ability to load without disassembly 95 per cent. of all types of Army Field Force's equipment. It has nose-loading doors with vehicle ramps, a rear cargo hatch with elevator loading and auxiliary floor for double deck loading.

The last Globemaster II was delivered to the U.S.A.F. on May 9, 1955. In five years 446 C-124's were built at the Long Beach plant.

The following versions of the Globemaster II were built :—

YC-124. Prototype. Four 3,000 h.p. Pratt & Whitney R-4360-35 engines driving four-blade airscrews. First flew on November 27, 1949.

C-124A. First production model. Four 3,500 h.p. Pratt & Whitney R-4360-20W engines driving Curtiss three-blade feathering and reversible airscrews 16 ft. 7 in. (5.06 m.) in diameter. Later fitted with thermal de-icing and APS-42 search radar as originally installed in C-124C.

YC-124B. One Globemaster fitted with four 5,500 h.p. Pratt & Whitney YT34-P-1 turboprop engines. Developed to



The Douglas C-124A Globemaster II Military Transport (3,500 h.p. Pratt & Whitney R-4360-20W engines).



The Douglas F5D-1 Skylancer Multi-purpose Naval Fighter (Pratt & Whitney J57 turbojet engine with afterburner).

provide technical data on the operation of turboprop propulsive systems and also to test the power-plant installation selected for the C-133. Flew for the first time on February 2, 1954. A.U.W. 200,000 lb. (90,800 kg.).

C-124C. Four 3,800 h.p. Ford-built Pratt & Whitney R-4360-63 engines. Development of C-124A. Fitted with APS-42 search radar in nose radome. Second production model. Production ceased in May, 1955.

One C-124 has been modified to flight-test the Pratt & Whitney T57 turboprop engine, which is mounted in the nose of the fuselage.

The following description refers to the C-124C.

TYPE.—Four-engined Military transport.

WINGS.—Cantilever low-wing monoplane. Low-drag laminar flow aerofoil section. All-metal two-spar stressed-skin structure. Centre-section span 101 ft. 8 in. (30.99 m.). Full-span Fowler-type flaps, outer sections of which act as ailerons. Thermal de-icing with combustion heaters in streamline casings at wing-tips.

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with stressed skin over fin and tailplane and fabric covering on statically-balanced rudder and elevators. Trim-tab in rudder and trim and balance-tabs in elevators. Thermal de-icing on leading-edges of fin and tailplane with combustion heater in tail cone. Tail-plane span 53 ft. 0 in. (16.15 m.).

LANDING GEAR.—Retractable tricycle type. All units have dual wheels. Track (centre-lines of legs) 34 ft. 2 in. (10.41 m.). Wheel base 37 ft. 3 in. (11.35 m.). Emergency bumper skid under rear fuselage.

POWER PLANT.—Four 3,800 h.p. Pratt & Whitney Wasp Major R-4360-63 twenty-eight-cylinder four-row radial air-cooled engines. Curtiss three-blade full-feathering and reversible airscrews, 17 ft. (5.18 m.) in diameter. Entry doors in wing root and in each nacelle allow inspection of engines in flight. Maximum fuel capacity 11,000 U.S. gallons (41.532 litres) carried in twelve integral wing tanks with all-electric fuel management controls and single-point manifold-type refuelling.

ACCOMMODATION.—Pilot's compartment seating two side-by-side in nose, with compartment immediately behind for flight-engineer, radio-operator and navigator. Galley, crew lavatory and relief crew compartment, with rest bunks, etc., further aft. Main cargo hold 77 ft. (23.48 m.) long, 12 ft. 10 in. (3.91 m.) high and 13 ft. (3.96 m.) wide, providing more than 10,000 cub. ft. (283 m.^{3}) of usable cargo space. Clamshell doors in nose ahead of nose-wheel provide an opening 11 ft. 8 in. (3.55 m.) high and 11 ft. 4 in. (3.45 m.) wide through which tracked or wheeled vehicles can be driven or rolled up built-in ramps. Electrically-operated elevator in middle of cargo hold, just aft of wing trailing-edge, provides additional loading and unloading facilities. Floor covered with 20 in. (50.8 cm.) grid pattern of heavy-duty tie down fittings. Two overhead travelling cranes, each lifting 8,000 lb. (3,629 kg.) or 16,000 lb. (7,258 kg.) run length of hold. For personnel transport interior of hold can be converted into a double-deck cabin with capacity for 200 troops and their field equipment. Fitted as an ambulance it can accommodate 127 stretcher cases, plus 52 sitting patients and medical attendants.

DIMENSIONS.—
Span 174 ft. 1½ in. (53.10 m.).
Length 130 ft. 5 in. (39.77 m.).
Height 48 ft. 3½ in. (14.72 m.).

WEIGHTS.—
Payload 50,000 lb. (22,700 kg.).
Weight loaded 175,000 lb. (79,450 kg.).

PERFORMANCE.—
No data available.

THE DOUGLAS SKYLANCER.

U.S. Navy designation: F5D.

The Skylancer is a development of the F4D Skyray, with the same wing planform and general appearance, but with a thinner wing, more slender and longer fuselage, vee-shaped windscreen and increased fuel capacity which give improved all-round performance. Few details are available except that it is a multi-purpose naval aircraft, serving either as a day fighter or all-weather interceptor and is powered by a Pratt & Whitney J57-P-12 turbojet with afterburner. The prototype made its first flight on April 21, 1956 and exceeded the speed of sound soon afterwards.

Plans to produce the Skylancer at the Douglas El Segundo Division were terminated by the U.S. Navy, due to lack of funds, and only two prototypes and a small number of pre-production F5D's have been ordered.

THE DOUGLAS SKYRAY.

U.S. Navy Designation: F4D.

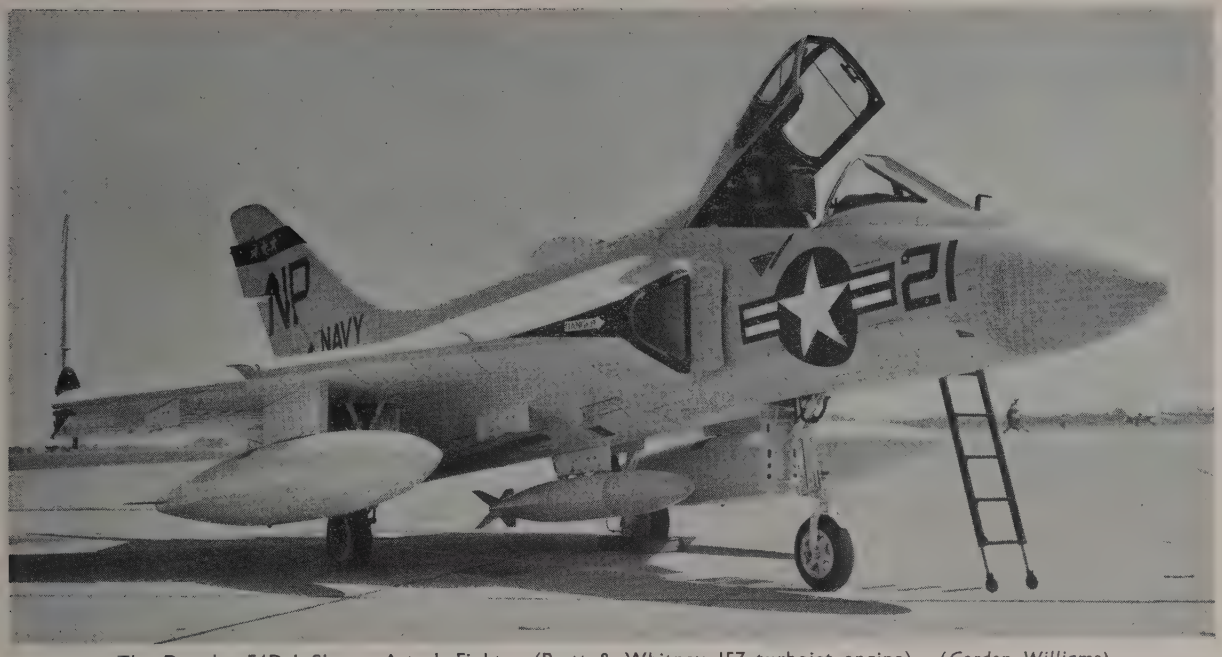
The F4D Skyray is a single-seat delta-wing tail-less monoplane which has been designed for the U.S. Navy as a supersonic carrier based interceptor fighter. The F4D was designed round the Westinghouse J40-WE-8 engine with afterburner, but owing to delays in the production of this engine the prototype XF4D-1 made its first flight on January 23, 1951, powered by an Allison J35-A-17 turbojet engine. It was later re-engined with the Westinghouse J40-WE-8.

On October 3, 1953, the XF4D-1 powered by a Westinghouse J40-WE-8 engine with afterburner, set up a World's Speed Record over the 3-km. course at Salton Sea, California, at 752.9 m.p.h. (1,211.746 km.h.).

Two weeks later, on October 16, the same aircraft covered the 100-km. 12-pylon closed circuit at Edwards A.F.B. at 728.11 m.p.h. (1,171.788 km.h.) to



The Douglas F4D-1 Skyray Attack Fighter (Pratt & Whitney J57 turbojet engine).



The Douglas F4D-1 Skyray Attack Fighter (Pratt & Whitney J57 turbojet engine). (*Gordon Williams*).

establish a new World's record for the distance.

The F4D-1 Skyray is in production at the El Segundo Division, powered by the Pratt & Whitney J57-P-2 turbojet engine (9,700 lb.=4,400 kg. s.t. without afterburner).

Armament consists of an unspecified number of 20 mm. cannon and there is provision for carrying various sizes and numbers of rocket packages or two bombs up to 2,000 lb. (908 kg.) under the wings. An Aero 13F fire-control system is fitted.

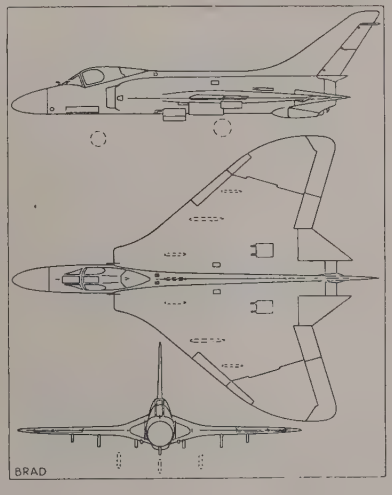
DIMENSIONS.—
Span 33 ft. 6 in. (10.21 m.).
Length 44 ft. 4 in. (13.43 m.).
Height 13 ft. (3.96 m.).
Wing area 557 sq. ft. (51.75 m.²).

WEIGHT.—
Loaded (approx.) 25,000 lb. (11,350 kg.).

THE DOUGLAS SKYHAWK.
U.S. Navy designation: A4D.

The Skyhawk is a single-seat light-weight attack bomber which is less than half the size of, and is superior in per-formance to, many current operational jet fighters. It is the smallest and lightest U.S. jet-powered combat aircraft ever built.

The maiden flight of the XA4D-1 powered by a Wright J65-W-2 engine (7,200 lb.=3,270 kg. s.t.) took place on June 22, 1954, two weeks after the aircraft was completed.



The Douglas F4D-1 Skyray.

The following versions have been mentioned :—

A4D-1. Initial production version with Wright J65-W-4 turbojet engine (7,800 lb.=3,540 kg. s.t.). Entered service with U.S. Atlantic and Pacific Fleets in Autumn of 1956.

A4D-2. Similar to -1 but fitted with split-plate rudder and powered tail.

A4D-3. Projected development of A4D-2, with improved navigational and bombing equipment, longer range and Pratt & Whitney J52 turbojet engine (7,500 lb.=3,400 kg. s.t.). Contract cancelled in 1957.

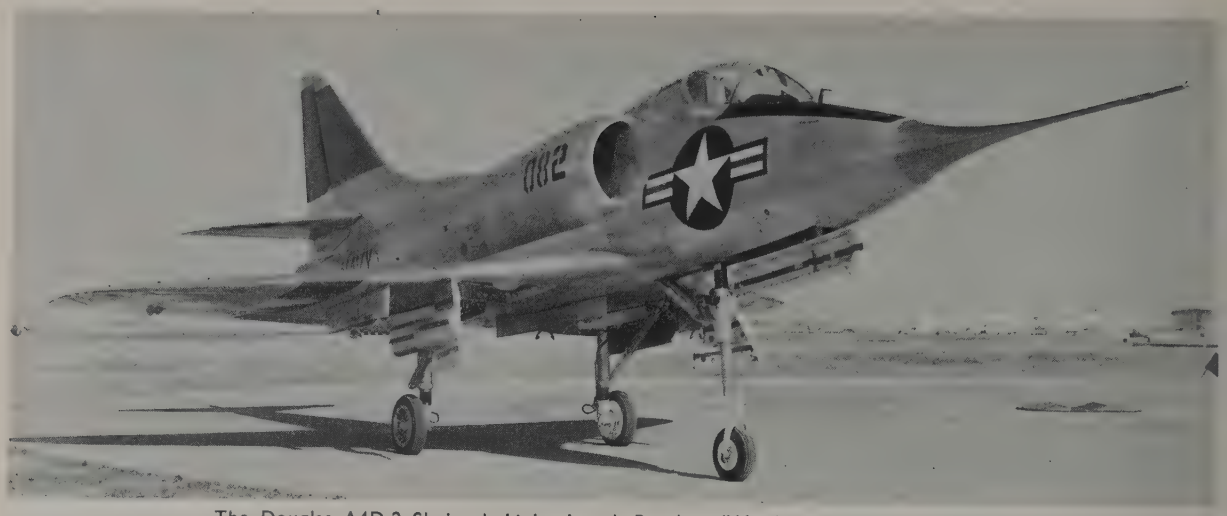
Designed to operate from all sizes of aircraft-carriers and from short landing fields, the Skyhawk is capable of carrying atom bombs, or rockets, missiles and other weapons to suit the wide variety of missions of Attack-type aircraft. It is claimed that the Skyhawk will fly faster over greater distances with a more power-ful strike load than any other aircraft of its type.

The Skyhawk is an all-metal low-wing monoplane of such dimensions that it will negotiate the standard aircraft carrier lift without the need for folding wings.

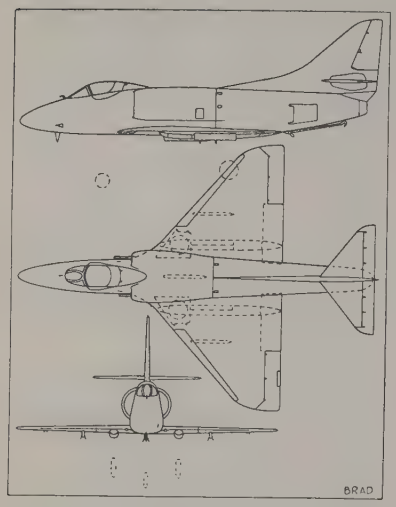
Designed on a completely functional basis with emphasis on simplification of structure and equipment, the first A4D was completed in eighteen months from the time the design work was started. As examples of weight-saving achieved, the air-conditioning system of the A4D is one-third the weight of the system previously used, while the pilot's ejector



The Douglas A4D-1 Skyhawk Light Attack Bomber (Wright J65 turbojet engine). (*Gordon Williams*).



The Douglas A4D-2 Skyhawk Light Attack Bomber (Wright J65 turbojet engine).



The Douglas A4D-1 Skyhawk.

seat is almost one half the weight of the seat used in the A4D's predecessor. By design simplification the A4D gained 20 per cent. more in speed and a third more in range than was at first thought possible.

The internal fuel capacity of the A4D, in wing and fuselage tanks, is 770 U.S. gallons (2,910 litres) which gives an endurance of 2.75 hours. Two 250 or one 300 U.S. gallon auxiliary tank can be carried under wings or fuselage. In addition, a Douglas-developed self-contained flight refuelling unit can be carried on the standard bomb shackles to enable the A4D to operate as a flying "tanker."

Standard armament consists of two 20 mm. cannon in the wing roots, and stores which can be carried include rockets, torpedoes, missiles and a wide variety of bombs, including nuclear weapons.

On October 15, 1955, the A4D established a new World's Speed Record over the 500-km. closed circuit at Edwards AFB at 695.163 m.p.h. (1,118.67 km.h.).

DIMENSIONS.—
Span 27 ft. 6 in. (8.38 m.).
Length 39 ft. 1 in. (11.91 m.).
Height 15 ft. 2 in. (4.62 m.).

WEIGHT.—
Loaded (approx.) 15,000 lb. (6,810 kg.).

THE DOUGLAS SKYWARRIOR.

U.S. Navy designation: A3D.

The A3D is a twin-jet swept-wing carrier-based Attack Bomber which is able to operate off carriers of the "*Essex*," "*Midway*" and "*Forrestal*" classes. The most powerful aircraft ever designed for carrier operation, the A3D can carry the largest types of bombs, including nuclear weapons. It can be used for high-altitude high-speed attack or for low-level attack or mine-laying. It can also be adapted for photographic reconnaissance duties.

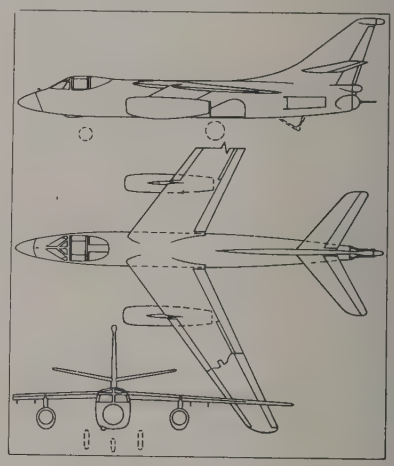
All A3D's have probes for in-flight refuelling and a special pack developed by Flight Refueling Inc., enables them to be adapted quickly for service as refuelling tankers.

The prototype XA3D-1 flew for the first time on October 28, 1952, powered with two Westinghouse J40 engines.

The A3D Skywarrior is in production at the El Segundo Division, and the first production aircraft flew for the first time on September 16, 1953.

Five versions have been announced :—

A3D-1. Initial production series with two Pratt & Whitney J57-P-6 turbojet engines (each 11,000 lb.=4,990 kg. s.t.) Entered service in April, 1956.



The Douglas A3D Skywarrior.



The Douglas A3D-1 Skywarrior Attack Bomber with wings and vertical tail surfaces being folded. (*Gordon Williams*).



The Douglas B-66B Light Bomber (two Allison J71 turbojet engines).

A3D-2. Developed version with Pratt & Whitney J57-P-10 turbojet engines. Entered service with U.S. Pacific Fleet early in 1957. Claimed to fly at high subsonic speeds above 40,000 ft. (12,200 m.).

A3D-2P. Photographic-reconnaissance version of A3D-2, with crew of three and 12 cameras. Re-designed and reinforced fuselage, pressurised to give equivalent of 8,000 ft. (2,440 m.) at 35,000 ft. (10,670 m.). Tail armament retained.

A3D-2Q. Radar countermeasures version of A3D-2, with crew of seven and specialised equipment.

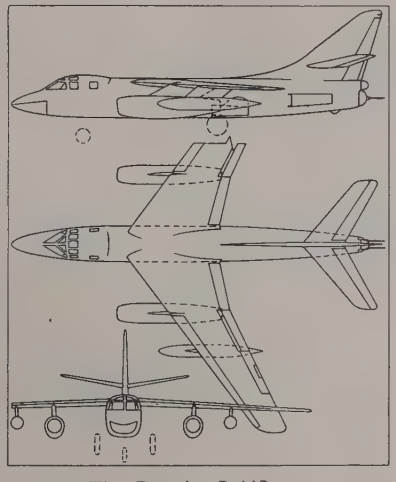
A3D-2T. Bombardier trainer, under development, with radar bomb sights and navigation gear. Accommodation for pilot, one instructor and six pupils. Tail armament retained.

TYPE.—Twin-jet Attack Bomber.

WINGS.—Shoulder-wing cantilever monoplane. 36° sweepback at 25% of chord. Aspect ratio 6.75. Taper ratio 6% at root, 8.25% at tip. Dihedral nil. All-metal two-spar torsion-box type structure. Outer wings fold upward hydraulically for carrier stowage. Hydraulically-operated NACA slotted flaps inboard of wing fold. Lateral control by combination of ailerons and spoilers on outer wings. Automatic leading-edge slats outboard of engine pod struts. Gross wing area 730 sq. ft. (67.82 $m.^2$).

FUSELAGE.—All-metal structure in three sections, nose, centre and tail-cone. Air-brakes on sides of rear fuselage. Extendable anti-buffet "rake" forward of weapons bay.

TAIL UNIT.—All-metal cantilever monoplane type with all-moving tailplane. All surfaces swept. Vertical surfaces fold down to starboard for carrier stowage. Hydraulically-powered control system.



The Douglas B-66B.

LANDING GEAR.—Retractable nose-wheel type. Nose-wheel retracts forward, main wheels sideways and backward, all into fuselage. Hydraulic actuation. Braking parachute stowed under rear gun turret. Retractable tail bumper and arrester hook. Wheel track 11 ft. (3.35 m.).

POWER PLANT.—Two Pratt & Whitney J57 turbojet engines in underwing pods. Fuel in four tanks, two self-sealing in fuselage, one forward and one aft of bomb-bay, and two integral wing tanks, one in each wing inboard of wing fold. Twelve 4,500 lb. (2,040 kg.) s.t. jettisonable T.O. rockets may be mounted on sides of rear fuselage.

ACCOMMODATION.—Crew of three, pilot and co-pilot/bombardier side-by-side and navigator/gunner behind pilot back-to-back, in pressurised cockpit. Emergency exit for all members of crew through floor escape chute of type first installed in F3D. Upper ditching hatch.

ARMAMENT.— Radar-directed Westinghouse ball-turret in rear end of fuselage armed with two 20 mm. cannon. Bomb-bay 15 ft. (4.57 m.) long adaptable to carriage of variety of offensive stores.

DIMENSIONS.—
Span 72 ft. 6 in. (22.11 m.).
Length 73 ft. 6 in. (22.41 m.).
Height 22 ft. 9 in. (6.94 m.).

WEIGHTS.—
Weight empty approx. 38,000 lb. (17,240 kg.).
Normal loaded weight 70,000 lb. (31,780 kg.).
Overload weight 73,000 lb. (33,110 kg.).

PERFORMANCE (approx.).—
Max. speed 630 m.p.h. (1,014 km.h.).
Landing speed 167 m.p.h. (269 km.h.).
Service ceiling 45,000 ft. (13,720 m.).
Normal range 2,000 miles (3,220 km.).

THE DOUGLAS DESTROYER.

U.S.A.F. designations: B-66 and RB-66.

The B-66 three-seat high-performance light bomber, which is in production for the U.S.A.F., is based on the A3D previously described, with design and engineering changes to modify the carrier-based aircraft design into a land-based bomber.

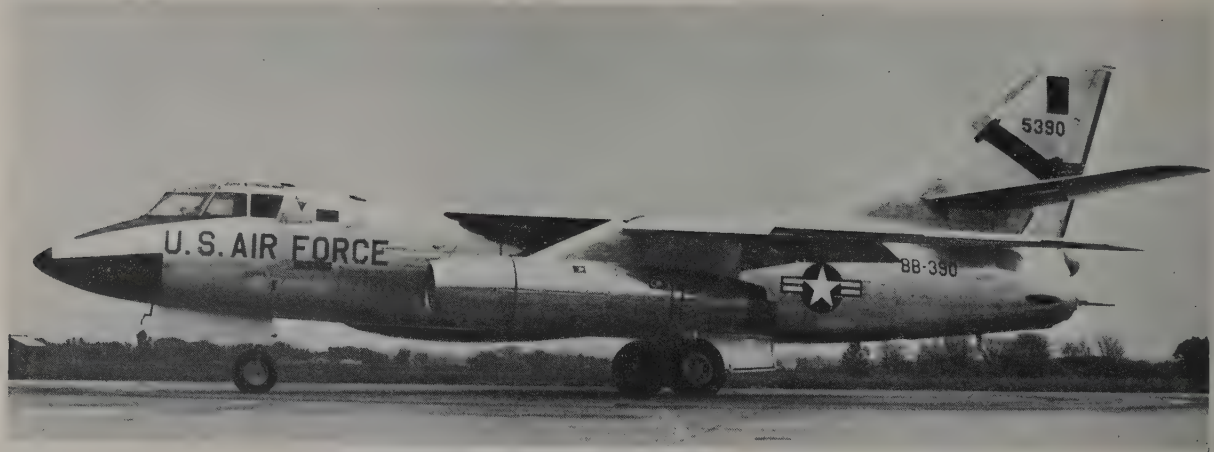
Versions of the basic B-66 so far announced are :—

RB-66A. First five production aircraft, used for service test only. Allison J71-A-9 turbojet engines. First RB-66A flew on June 28, 1954.

B-66B. First production bomber version, fitted with in-flight refuelling equipment. First B-66B flew on January 4,



The Douglas RB-66B, the reconnaissance version of the B-66B Light Bomber. (*J. D. Rawlings*).



The Douglas WB-66D, the Weather Reconnaissance version of the RB-66C.

1955. Early machines with Allison J71-A-9 turbojets; later models with J71-A-11. Deliveries to U.S.A.F. began on March 10, 1956.

RB-66B. Production development of RB-66A for night photographic reconnaissance, incorporating improvements introduced on B-66B.

RB-66C. Development of RB-66B for all-weather electronics reconnaissance. In production. First RB-66C flew on October 29, 1955

WB-66D. First production aircraft ever designed specifically for weather reconnaissance. Equipped with instruments to collect meteorological data over combat area or for normal Air Weather Service duties. Data fed into electronic computer to obtain complete weather report.

The RB-66 is in the 600-700 m.p.h. (965-1,126 km.h.) class and has a range of 1,500-1,750 miles (2,415-2,815 km.), but no other performance data is available for publication.

The structural description given for the A3D can be assumed to apply in general to the B-66. The information given below, however, refers primarily to the latter aircraft.

TYPE.—Twin-jet Bomber (B-66), Tactical Reconnaissance aircraft (RB-66) or Weather Reconnaissance (WB-66).

WINGS.—As for A3D but without wing folding. All-metal stressed-skin structure. All-metal single-slotted flaps. All-metal internal-pressure-balanced ailerons. Thermo-cyclic de-icing system. Areas: flaps (total) 108.8 sq. ft. (10.11 m.²), ailerons (total) 32.6 sq. ft. (3.03 m.²). Gross wing area 780 sq. ft. (72.5 m.²).

FUSELAGE.—Aluminium-alloy and magnesium semi-monocoque structure.

TAIL UNIT.—As for A3D but vertical surfaces non-folding. Thermo-cyclic de-icing to fin and tailplane. Areas: fin 129.9 sq. ft. (12.07 m.²), rudder 32.5 sq. ft. (3.02 m.²), tailplane 114.8 sq. ft. (10.66 m.²), elevators (total) 52.2 sq. ft. (4.85 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic actuation. Air-oil shock struts designed by Douglas and manufactured by Cleveland Pneumatic Tool Co. Bendix disc brakes. Large ribbon braking parachute stowed under rear gun turret. Wheelbase 26 ft. 7¾ in. (8.11 m.). Track 10 ft. 10 in. (3.30 m.).

POWER PLANT.—Two Allison J71-A-11 turbojet engines (10,200 lb. = 4,627 kg. s.t. each) in underwing pods. Two wing and two fuselage tanks. Normal internal fuel capacity 4,650 U.S. gallons (17,580 litres). Auxiliary fuel in pylon-mounted underwing tanks, and provision for wing-tip tanks on RB-66C. Equipment for probe and drogue flight refuelling.

ACCOMMODATION.—Pilot seated in front of navigator and gunner. All three in ejector seats, with explosively-jettisonable roof hatches. Pressurised and air-conditioned. Normal pressure differential of 5 lb./sq. in. (0.35 kg./cm.²) reduced to 2.75 lb./sq. in. (0.19 kg./cm.²) for combat.

ARMAMENT AND EQUIPMENT.—Two 20 mm. cannon in tail ball-turret. General Electric electronic fire-control system. Provision for wide selection of bomb combinations, including nuclear weapons, in internal bay (B-66). Photographic equipment, comprising five cameras, photoflash bombs and cartridges, in RB-66. Meteorological instruments and computer in WB-66.

DIMENSIONS.—
Span 72 ft. 6 in. (22.11 m.).
Length 75 ft. 2 in. (22.9 m.).
Height 23 ft. 7 in. (7.18 m.).

WEIGHTS (B-66B).—
Weight empty 40,330 lb. (18,293 kg.).
Normal loaded weight 78,000 lb. (35,380 kg.).
Max. overloaded weight 83,000 lb. (37,648 kg.).

WEIGHTS (RB-66A).—
Weight empty 39,686 lb. (18,000 kg.).
Normal loaded weight 70,000 lb. (31,750 kg.).
Max. overloaded weight 79,000 lb. (35,834 kg.).

PERFORMANCE.—
No data available.

THE DOUGLAS SKYRAIDER.

U.S. Navy designation: AD.

The Skyraider was the third design conceived by the Douglas company to replace the SBD dive-bomber. Under the original designation XBT2D-1, the design was submitted to the U.S. Navy in July, 1944, and the prototype first flew on March 18, 1945. It went into production under the simplified Naval Attack designation AD. Since then the aircraft has undergone considerable development, resulting in the AD-2, AD-3, AD-4, AD-5, AD-6 and AD-7, and a total of 49 versions of the seven basic types has been produced.

The Skyraider was in continuous production for twelve years until February, 1957, when the last of a total of 3,180 was delivered to the U.S. Navy.

Originally conceived in 1944 to carry a 1,000-lb. bomb, the Skyraider was operating in the Korean war with loads totalling 10,500 lbs., more than that carried by the four-engined B-17 Flying Fortress in World War II. The AD's conversion to carry atomic bombs was announced by the U.S. Navy Department in 1953.

In addition, Skyraiders can carry Douglas-developed self-contained flight refuelling packs for operation as flying "tankers."



The Douglas AD-6 Skyraider with a Douglas-developed in-flight refuelling store on the centre bomb-rack and 2 × 400 U.S. gallon fuel tanks on under-wing pylons.

The following are the principal versions of the Skyraider :—

AD-1. 2,400 h.p. Wright R-3350-24 engine. First production series. Sub-types include (*a*) AD-1Q radar countermeasure aircraft with additional radar operator ; (*b*) XAD-1W special search and early-warning radar aircraft with two additional radar operators ; and AD-1N night attack aircraft with two additional radar operators. All additional crews carried in rear fuselage.

AD-2. 2,700 h.p. Wright R-3350-26W engine. Increased performance and many internal refinements to give simplified control, improved vision, etc. AD-2Q (and AD-2Q(U) target tug), AD-2W and AD-2N tactical versions (see functions under AD-1).

AD-3. 2,700 h.p. Wright R-3350-26W engine. Strengthened landing-gear and longer-stroke oleo legs, improved canopy, etc., AD-3Q, AD-3W, AD-3N, AD-3S (anti-submarine) and AD-3E (special electronic equipment) versions.

AD-4. Development of AD-3. Redesigned cockpit, auto-pilot fitted, improved radar, etc. AD-4B modified to carry "special weapons" into production in 1952. Also AD-4Q, AD-4W and AD-4N special multi-seat tactical models. AD-4W in service with Royal Navy as Skyraider AEW Mk. 1.

AD-5. 2,700 h.p. Wright R-3350-26WA engine. "Multiplex" version permitting basic single-seat aircraft to be converted with standard kits to any one of twelve or more combat or tactical versions, including day or night attack, photographic reconnaissance, target-tug, -Q, -N, -W, and -S special radar-equipped multi-seaters, passenger-carrying (eight persons) and ambulance (four stretchers) versions. Redesigned fuselage with new wider cockpit to permit side-by-side seating, direct communication between crew members and complete interchangeability of stations, larger vertical tail surfaces, etc. Normal loaded weight 18,800 lb. (8,535 kg.). 670 built.

AD-6. 2,700 h.p. Wright R-3350-26WA engine. Improved AD-4 with special equipment for attack bombing.

AD-7. Wright R-3350-26WB engine. Strengthened wings and landing gear to prolong service life under increasing tactical loads. Deliveries began in August, 1956 and the 72nd and last AD-7 was delivered on February 18, 1957.

The following description refers to the AD-6 :—

TYPE.—Single-seat Naval Attack monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure in three main sections, comprising a centre-section and two upward-folding outer sections. Hydraulic folding controlled from cockpit. Gross wing area 400.33 sq. ft. (37.19 m.²). All-metal ailerons on outer sections with trim and balance tabs in each. Hydraulically operated Fowler-type trailing-edge landing flaps on centre-section.

FUSELAGE.—All-metal monocoque structure with integral fin. The dive-brakes are components of the fuselage and consist of three rectangular surfaces, one on each lower side of the fuselage and one below, hinged at their forward ends in line with the trailing-edge of the wings. These surfaces are extended hydraulically outwards and downwards into the airstream.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering of movable surfaces. Electrically-controlled adjustable tailplane. Aerodynamically and statically balanced rudder and elevators. Trim and balance tabs in rudder.

LANDING GEAR.—Retractable two-wheel type. Main wheels on single compression legs are raised backwards and turn through 90 degrees while retracting to lie flat within wing. Hydraulic actuation. Forwardly-retracting tail-wheel. Deck arrester hook aft of tail wheel.

POWER PLANT.—One 2,700 h.p. Wright R-3350-26W eighteen-cylinder two-row radial air-cooled engine. Engine mounted at 4½° downthrust. Aeroproducts four-blade constant-speed airscrew 13 ft. 6 in. (4.11 m.) diameter. Single leakproof fuel cell occupies the entire fuselage bay aft of the pilot's cockpit. Long-range fuel tanks may be carried on the wing bomb shackles.

ACCOMMODATION. — Pilot's cockpit with blister-type blown canopy over fore part of wing with downward vision angle of 15 degrees. Full naval radio and radar equipment.

ARMAMENT.—Two 20 mm. cannon, one in each extremity of the centre-section inboard of the wing-fold hinges. Launchers for twelve 5 in. (12.7 cm.) zero-length and two 12 in. (30.5 cm.) "Tiny Tim" rocket projectiles under wings. Torpedo carried externally in crutches under the fuselage. Bomb racks under the fuselage and each outer wing.

DIMENIONS.—
Span 50 ft. 9 in. (15.47 m.).
Width folded 24 ft. (7.32 m.).
Length 39 ft. (11.89 m.).
Height (over airscrew) 15 ft. 7 in. (4.75 m.).

WEIGHTS.—
Weight empty 10,550 lb. (4,790 kg.).
Normal loaded weight 19,000 lb. (8,618 kg.).
Max. overload weight 25,000 lb. (11,350 kg.).

PERFORMANCE.—
Max. speed 365 m.p.h. (584 km.h.) at 15,000 ft. (4,575 m.).
Initial rate of climb 2,850 ft./min. (870 m./min.).
Service ceiling over 25,000 ft. (7,620 m.).
Max. combat radius 1,500 miles (2,412 km.).

THE DOUGLAS DC-8.

The DC-8, production of which has begun, will be a four-jet swept-wing civil airliner which will have accommodation for 118-132 passengers in the first-class version or up to 171 in the "coach" version.

The basic aeroplane will be available in a domestic version powered by either the Pratt & Whitney JT3C-6 (J57) or JT4A-3 (J75) turbojet engine, or in an inter-continental version with the JT4A-3 (J75) engine. Both versions are also available with the Rolls-Royce Conway by-pass engine.

As all DC-8's will have the same overall dimensions, the aerodynamic characteristics and the location of major elements are identical. The electrical, hydraulic, control and air-conditioning systems will be uniform for all versions.

The intercontinental DC-8 will differ from the domestic version only in its added fuel capacity and the structural modifications needed to carry the additional fuel. The modifications are limited to the use of thicker skin and stringer material within the wing structure, the aft portion of the fuselage and the tailplane. The landing gear will also be more robust in the case of the heavier intercontinental version.

At the time of writing the following airlines had placed firm orders for a total of 124 DC-8's :—Eastern Airlines (18),



A Douglas Skyraider "Hunter-Killer" team, the AD-5W Three-seat Search and (behind) the AD-6 Single-seat Attack versions.

Japan Airlines (4), K.L.M. (8), Pan American World Airways (25), Pan American-Grace Airways (4), SAS (7), Trans-Canada Air Lines (6), United Airlines (30), National Air Lines (6), Swissair (3), Delta Airlines (6), U.A.T. (3), T.A.I. (2) and Olympic Airways (2).

There will be no prototype of the DC-8 and the C.A.A. certification programme will be conducted with up to nine production aircraft, comprising three with JT3 engines, four with JT4 engines and two with Conway engines. The first DC-8 is scheduled to fly in March, 1958, and target date for C.A.A. certification is August, 1959.

TYPE.—Four-engined Jet Airliner.

WINGS.—Swept-wing cantilever monoplane. 30° sweep. All-metal two-spar structure. Two double-slotted flaps on each wing. Power-operated ailerons in two portions, outer portions being operated from inner portions via torsion-bar springs. Self-coupling manual circuit to tabs on inner ailerons in event of power failure. Spoilers on top wing surface forward of flaps operate automatically on nosewheel contact during landing. Gross wing area 2,758 sq. ft. (256.3 m.²).

FUSELAGE.—Circular-section all-metal structure. Two-piece hydraulically-actuated speed brake under fuselage.

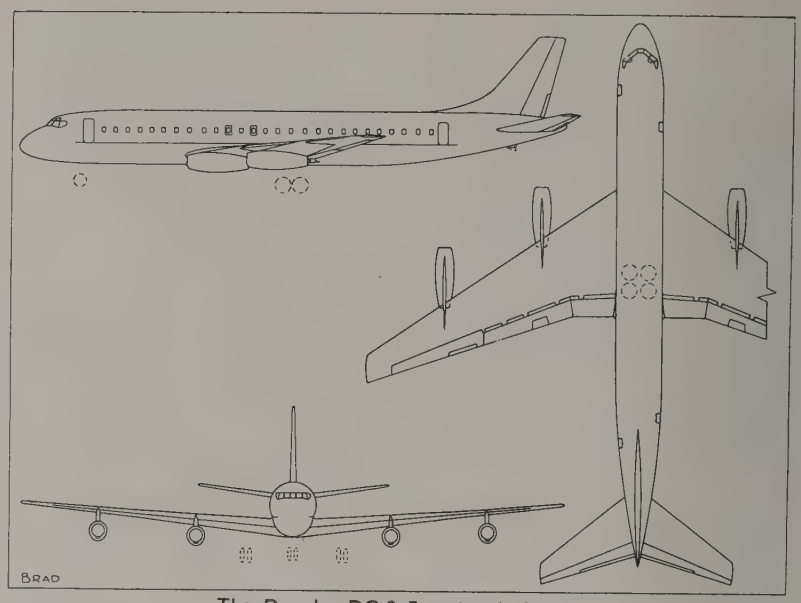
TAIL UNIT.—Cantilever all-metal structure. Hydraulically-operated variable-incidence tailplane. Power-operated rudder with manual standby. Elevators manually-operated through tabs.

LANDING GEAR.—Retractable tricycle type. Main units are four-wheel bogies, the rear pair of wheels on each bogie being free to swivel. Dual nose-wheel steerable through rudder pedals. Wheel track 21 ft. 6 in. (6.55 m.).

POWER PLANT.—Four Pratt & Whitney JT3C-6 or JT4A-3 turbojet engines or four Rolls-Royce Conway R.Co.10 by-pass turbojet engines in four separate pods, two under each wing. All engines fitted with noise suppressors and thrust reversers. All fuel in integral wing tanks with total capacity of 17,600 U.S. gallons (66,528 litres) on domestic versions and 21,615 U.S. gallons (81,705 litres) on intercontinental versions. Pressure refuelling. Powered fuel dumping at maximum rate of 1,800 U.S. gallons (6,815 litres) per minute.

ACCOMMODATION.—Normal first class seating for 118 persons in domestic versions and for 132 persons in intercontinental versions, with normal tourist accommodation for 144 and "coach" seating for 171 in all versions. Mixed-class arrangements to suit requirements of customer. Windows, size 16 in. by 14 in. (0.41 m. × 0.36 m.) correspond with rows of first-class seats. Internal dimensions of cabin: length 102 ft. 1 in. (31.11 m.), maximum width 11 ft. 6 in. (3.50 m.), maximum height 7 ft. 3 in. (2.21 m.). Volume of freight and baggage compartments under cabin floor 1,415 cub. ft. (40.06 m.³).

DIMENSIONS.—
Span 139 ft. 8 in. (42.57 m.).
Length 150 ft. 6 in. (45.87 m.).
Height 42 ft. 4 in. (12.91 m.).



The Douglas DC-8 Four-jet Airliner.

WEIGHTS AND LOADINGS (Domestic—P. & W. JT3C-6 (J57) engines).—
Weight empty (operating) 121,034 lb. (54,900 kg.).
Max. usable T.O. weight 264,400 lb. (120,040 kg.).
Design gross weight 265,000 lb. (120,310 kg.).
Design landing weight 189,000 lb. (85,810 kg.).
Capacity payload 41,166 lb. (18,672 kg.).
Max. wing loading 96.1 lb./sq. ft. (469.2 kg./m.²).
Max. power loading 5.1 lb./lb. s.t. (5.1 kg./kg. s.t.).

WEIGHTS AND LOADINGS (Domestic—P. & W. JT4A-3 (J75) engines).—
Weight empty (operating) 123,242 lb. (55,900 kg.).
Max. T.O. weight 265,000 lb. (120,310 kg.).
Design landing weight 189,000 lb. (85,810 kg.).
Capacity payload 41,758 lb. (18,941 kg.).
Max. wing loading 96.1 lb./sq. ft. (469.2 kg./m.²).
Max. power loading 4.14 lb./lb. s.t. (4.14 kg./kg. s.t.).

WEIGHTS AND LOADINGS (Inter-continental—P. & W. JT4A-3 (J75) engines).—
Weight empty (operating) 128,862 lb. (58,503 kg.).
Max. T.O. weight 287,500 lb. (130,525 kg.).
Design landing weight 190,500 lb. (86,487 kg.).
Capacity payload 38,688 lb. (17,549 kg.).
Max. wing loading 104.2 lb./sq. ft. (508.7 kg./m.²).
Max. power loading 4.5 lb./lb. s.t. (4.5 kg./kg. s.t.).

WEIGHTS AND LOADINGS (Intercontinental—Rolls-Royce Conway engines).—
Weight empty (operating) 124,472 lb. (56.459 kg.).
Max. T.O. weight 287,500 lb. (130,525 kg.).
Design landing weight 190,500 lb. (86,487 kg.).
Capacity payload 39,278 lb. (17,816 kg.).
Max. wing loading 104.2 lb./sq. ft. (508.7 kg./m.²).
Max. power loading 4.11 lb./lb. s.t. (4.11 kg./kg. s.t.).

PERFORMANCE (Domestic—P. & W. JT3C-6 (J57) engines).—
Recommended cruise at 200,000 lb. (90,720 kg.) A.U.W. at 30,000 ft. (9,150 m.) 566 m.p.h. (911 km.h.).
CAA field length required for T.O. at max. T.O. weight 9,860 ft. (3,005 m.).
Landing distance from 50 ft. (15.25 m.) at max. landing weight 3,910 ft. (1,192 m.).
Range with max. fuel at 548 m.p.h. (882 km.h.) at 34,000 ft. (10,360 m.) with 23,000 lb. (10,435 kg.) payload, no allowances, 5,550 miles (8,930 km.).
Range with max. payload, no reserves, 4,890 miles (7,870 km.).

PERFORMANCE (Domestic—P. & W. JT4A-3 (J75) engines).—
Recommended cruise at 200,000 lb. (90,720 kg.) A.U.W. at 30,000 ft. (9,150 m.) 568 m.p.h. (914 km.h.).
CAA field length required for T.O. at max. T.O. weight 7,280 ft. (2,220 m.).
Landing distance from 50 ft. (15.25 m.) at max. landing weight 3,970 ft. (1,210 m.).
Range with max. fuel at 551 m.p.h. (887 km.h.) at 36,000 ft. (10,970 m.) with 27,000 lb. (12,250 kg.) payload, no allowances, 5,400 miles (8,690 km.).
Range with max. payload, no reserves, 5,000 miles (8,050 km.).



A drawing of the Douglas DC-8 four-jet Airliner.



The Douglas DC-7 Airliner (four 3,250 h.p. Wright R-3350-18DA1 Turbo Compound engines).

PERFORMANCE (Intercontinental—P. & W. JT4A-3 (J75) engines).—
Recommended cruise at 220,000 lb. (100,000 kg.) A.U.W. at 30,000 ft. (9,150 m.) 570 m.p.h. (917 km.h.).
CAA field length required for T.O. at max. T.O. weight 8,760 ft. (2,670 m.).
Landing distance from 50 ft. (15.25 m.) at max. landing weight 4,000 ft. (1,220 m.).
Range with max. fuel at 551 m.p.h. (887 km.h.) at 36,000 ft. (10,970 m.) with 18,200 lb. (8,255 kg.) payload, no allowances, 6,720 miles (10,815 km.).
Range with max. payload, no reserves, 5,650 miles (9,093 km.).

PERFORMANCE (Intercontinental—Rolls-Royce Conway engines).—
Recommended cruise at 220,000 lb. (100,000 kg.) A.U.W. at 30,000 ft. (9,150 m.) 570 m.p.h. (917 km.h.).
CAA field length required for T.O. at max. T.O. weight 8,900 ft. (2,713 m.).
Landing distance from 50 ft. (15.25 m.) at max. landing weight 4,000 ft. (1,220 m.).
Range with max. fuel at 551 m.p.h. (887 km.h.) at 36,000 ft. (10,970 m.) with 22,500 lb. (10,205 kg.) payload, no allowances, 6,950 miles (11,185 km.).
Range with max. payload, no reserves, 6,130 miles (9,865 km.).

NOTE.—All range and performance data pertains to specific payload and weights indicated.

THE DOUGLAS DC-7.

The DC-7 is an evolutionary development of the DC-6 from which it differs mainly by having an 8 foot (2.44 m.) longer fuselage and a power-plant consisting of four 3,250 h.p. Wright Turbo Compound engines.

The DC-7 first went into service with American Air Lines on November 29, 1953.

TYPE.—Four-engined Airliner.
WINGS.— Low-wing cantilever monoplane. All-metal structure. Same as for DC-6. Gross wing area 1,463 sq. ft. (136 m.²).
FUSELAGE. — All-metal semi-monocoque structure as for DC-6.
TAIL UNIT.—Cantilever monoplane type. Same structure and areas as for DC-6.
LANDING GEAR.—Retractable tricycle type. Same as for DC-6 except wheelbase 36 ft. 2 in. (11 m.).
POWER PLANT.—Four 3,250 h.p. (T.O.) Wright R-3350-18DA1 Turbo Compound eighteen-cylinder radial air-cooled compounded engines, each driving a four-blade Hamilton Standard high activity airscrew 13 ft. 6 in. (4.1 m.) diameter. Fuel in eight wing tanks. Fuel capacity 5,512 U.S. gallons.
ACCOMMODATION.—Similar to DC-6. Crew of three (domestic) or five (oversea) plus cabin attendants. Accommodation for 60 passengers, plus six lounge seats in de-luxe version, or up to 95 in coach version. Automatically controlled air-conditioning and pressurisation to provide S/L atmosphere at 12,500 ft. (3,810 m.) equivalent of 5,000 ft. (1,525 m.) at 20,000 ft. (6,100 m.) and equivalent of 8,000 ft. (2,440 m.) at 25,000 ft. (7,625 m.). All freight and baggage space below cabin floor. Total cargo capacity 743 cub. ft. (21.0 m.³) or 14,200 lb. (6,441 kg.).
DIMENSIONS.—
Span 117 ft. 6 in. (35.81 m.).
Length 108 ft. 11 in. (33.24 m.).
Height 28 ft. 7 in. (8.72 m.).
WEIGHTS.—
Weight empty 66,306 lb. (30,076 kg.).
Payload (standard seating) 20,600 lb. (9,344 kg.).
Max. T.O. weight 122,200 lb. (55,429 kg.).
Max. landing weight 97,000 lb. (43,998 kg.).
PERFORMANCE.—
At 97,000 *lb.* = 43,998 *kg. A.U.W.*
Max. speed 410 m.p.h. (656 km.h.) at 22,200 ft. (6,767 m.).
Max. cruising speed 365 m.p.h. (584 km.h.) at 24,400 ft. (7,437 m.).
Stalling speed 100 m.p.h. (160 km.h.).
Rate of climb at S.L. 1,760 ft./min. (536 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 990 ft./min. (302 m /min.).
Service ceiling 27,900 ft. (8,504 m.).
Ceiling on three engines 23,900 ft. (7,285 m.).
At 102,000 *lb.* = 46,266 *kg. A.U.W.*
Max. speed 406 m.p.h. (653 km.h.) at 22,100 ft. (6,736 m.).
Max. cruising speed 360 m.p.h. (579 km.h.) at 24,300 ft. (7,406 m.).
Stalling speed 102.4 m.p.h. (164.8 km.h.).
Rate of climb at S.L. 1,620 ft./min. (494 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 870 ft./min. (265 m./min.).
Service ceiling 27,100 ft. (8,260 m.).
Ceiling on three engines 22,900 ft. (6,980 m.).
At 110,000 *lb.* = 49,895 *kg. A.U.W.*
Max. speed 401 m.p.h. (645 km.h.) at 22,000 ft. (6,706 m.).
Max. cruising speed 349 m.p.h. (562 km.h.) at 24,000 ft. (7,315 m.).
Stalling speed 106.3 m.p.h. (171 km.h.).
Rate of climb at S.L. 1,520 ft./min. (463 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 690 ft./min. (210 m./min.).
Service ceiling 25,900 ft. (7,894 m.).
Ceiling on three engines 21,400 ft. (6,523 m.).
RANGES.—
At 15,000 *ft.* = 4,575 *m.*
With 5,512 U.S. gallons (20,865 litres) fuel 4,430 miles (7,130 km.).
At 23,500 *ft.* = 7,163 m.
With 5,512 U.S. gallons (20,865 litres) fuel 3,905 miles (6,285 km.).

THE DOUGLAS DC-7B.

The DC-7B, the long-range intercontinental version of the DC-7 from which it differs in many respects.



The Douglas DC-7B Long-Range Airliner (four 3,350 h.p. Wright R-3350-18DA4 Turbo Compound engines).



The Douglas DC-7C Long-Range Airliner (four 3,400 h.p. Wright R-3350-18EA1 Turbo Compound engines).

The most important design change is a new flap linkage system which provides optimum position of the flap for take-off. By a re-location of the flap and vane with reference to the upper wing surface, the airflow characteristics over the flap have been improved, resulting in greater lift and reduced drag.

The fuel capacity has been increased from the 5,512 U.S. gallons of the DC-7 to 6,400 U.S. gallons by the addition of external saddle tanks which form part of the engine nacelles above the wing.

The power-plant of the DC-7B consists of four Wright Turbo Compound R-3350-18DA4 engines, each of which delivers 100 more METO horsepower than the earlier DA engines.

Cabin interiors are available to accommodate from 40 passengers in a *de luxe* version to 95 in the air-coach version.

DIMENSIONS.—
Same as for DC-7.

WEIGHTS.—
Weight empty 67,995 lb. (30,842 kg.).
Payload (standard seating) 22,650 lb. (10,274 kg.).
Max. T.O. weight 122,000 lb. (55,430 kg.).
Max. landing weight 102,000 lb. (46,265 kg.).

THE DOUGLAS DC-7C SEVEN SEAS.

The DC-7C is an improved version of the long-range DC-7B. It has a span of 127 ft. 6 in. (38.8 m.), 10 ft. (3.05 m.) more than that of the DC-7 and DC-7B. The extra span is added at the wing roots, the effect of which is to locate the inboard engines a further 5 ft. (1.5 m.) away from the fuselage. The increased span also gives space for additional fuel. The fuselage length has been increased by 40 in. (1.0 m.) forward of the wings. The vertical tail surfaces have been increased 2 ft. (0.6 m.) in height.

At the time of going to press, the following airlines had ordered the DC-7C: P.A.A. (25), Swissair (4), Sabena (10), SAS (14), Braniff (7), B.O.A.C. (10), K.L.M. (10), Alitalia (4), Mexicana (4), Northwest (14), T.A.I. (3), J.A.L. (4), Panair do Brasil (4), REAL Aerovias (3), Olympic (3).

TYPE.—Four-engined Intercontinental Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23016 at root, 2301476 at joint, 23012 at tip. Aspect ratio 9.93 Chord 17 ft. 11 in. (5.46 m.) at root, 5 ft. 11.3 in. (1.80 m.) at tip. Dihedral 7°. Incidence 4° at root and joint, 1° at tip. Three-spar all-metal structure. Double-slotted all-metal flaps. Total area of flaps (including vane) 269.2 sq. ft. (25.0 m.²). Total area of ailerons (aft of hinge-line) 93.4 sq. ft. (8.67 m.). Gross wing area 1,637 sq. ft. (152.0 m.²).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Two-spar all-metal structure. Areas: fin 120.4 sq. ft. (11.18 m.²), rudder (aft of hinge, including tab) 53.7 sq. ft. (4.98 m.²), tailplane 210.9 sq. ft. (19.59 m.²), elevators (total, aft of hinge-line) 108.9 sq. ft. (10.11 m.²). Tailplane span 46 ft. 6 in. (14.13 m.).

LANDING GEAR.—Retractable nose-wheel type with twin wheels on main units. Steerable nose-wheel. Cleveland air-oil shock-absorber struts. Hydraulic retraction. Goodrich nose-wheel. Goodyear main wheels and Goodyear disc brakes. Tubeless tyres, size 17.00 × 20 on main units, 15.00 × 16 on nose-wheel. Wheelbase 39 ft. 5½ in. (12.05 m.). Track 34 ft. 8 in. (10.57 m.).

POWER PLANT.—Four Wright R-3350-18EA1 Turbo Compound radial air-cooled engines. Ratings: T.O. 3,400 h.p. at sea level; METO 2,800 h.p. low blower at sea level and 2,850 h.p. low blower at 4,300 ft. (1,310 m.); max. cruise 1,900 h.p. at 14,800 ft. (4,515 m.) low blower, 1,800 h.p. at 24,400 ft. (7,440 m.) high blower. Hamilton Standard Hydromatic 34E60-345 constant-speed reversible four-blade airscrews with electric anti-icing. Diameter 14 ft. (4.27 m.). Fuel in eight wing tanks. Total capacity 7,824 U.S. gallons (29,575 litres). Oil capacity 246 U.S. gallons (920 litres).

ACCOMMODATION.—Varied internal arrangements are supplied from a 62 passenger combination dayplane/sleeper version to a 99-passenger tourist version. Usual over-water crew consists of captain, first officer, flight engineer, navigator and radio-operator. Two crew bunks are provided for long flights. Seats for two cabin attendants with third seat optional. Capacities of cargo compartments 13,440 lb. (6,100 kg.) lower, 5,000 lb. (2,270 kg.) upper.

DIMENSIONS.—
Span 127 ft. 6 in. (38.8 m.).
Length 112 ft. 3 in. (34.23 m.).
Height 31 ft. 8 in. (9.65 m.).

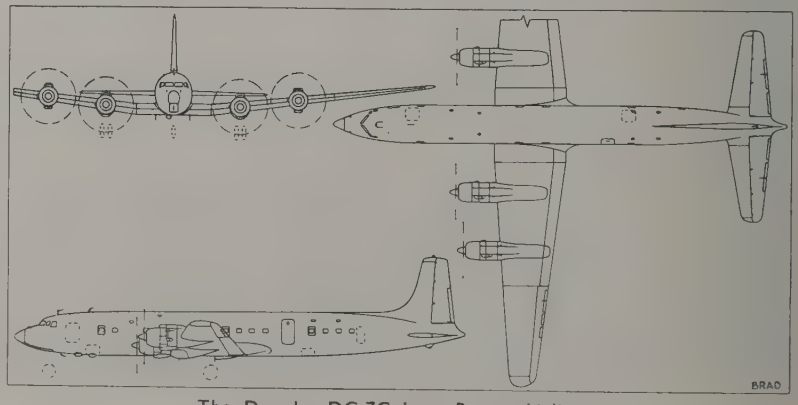
WEIGHTS (typical loading).—
Manufacturer's weight empty 72,763 lb. (33,034 kg.).
Operating weight empty 78,890 lb. (35,785 kg.).
Passengers (62 at 165 lb.=75 kg.) 10,230 lb. (4,645 kg.).
Cargo (at 10 lb./cub. ft.) 6,510 lb. (2,956 kg.).
Fuel (7,086 U.S. gallons=26,785 litres) 42,517 lb. (19,303 kg.).
Oil (220 U.S. gallons=823 litres) 1,650 lb. (749 kg.).
Max. T.O. weight 143,000 lb. (64,865 kg.).
Max. landing weight 109,000 lb. (49,490 kg.).

PERFORMANCE.—
Max. speed, rated power high blower, at 22,700 ft. (6,925 m.) at 107,000 lb. (48,535 kg.) A.U.W., 406 m.p.h. (653 km.h.).
Recommended max. cruising speed (1,800 h.p. per engine) at 21,600 ft. (6,585 m.) and 110,000 lb. (49,900 kg.) A.U.W. 346 m.p.h. (557 km.h.).
Stalling speed at landing weight 97 m.p.h. (156 km.h.).
Rate of climb at 20,000 ft. (6,100 m.) at max. A.U.W. 240 ft./min. (73 m./min.).
Service ceiling at max. A.U.W. 21,700 ft. (6,615 m.).
Service ceiling on 3 engines at 107,000 lb. (48,535 kg.) A.U.W., 22,300 ft. (6,795 m.).
Service ceiling on 3 engines at max. A.U.W. 14,600 ft. (4,450 m.).
CAA take-off field length at S/L. at max. A.U.W. 6,360 ft. (1,940 m.).
Landing distance from 50 ft. (15.25 m.) 5,100 ft. (1,555 m.).
Range with max. fuel and 15,310 lb. (6,945 kg.) payload at 274 m.p.h. (441 km.h.) mean at 15,000 ft. (4,570 m.) in still air, no allowances 5,635 miles (9,070 km.).
Range with max. payload, still air, no allowances 4,635 miles (7,460 km.).

THE DOUGLAS DC-7D

Douglas has developed a turboprop-powered cargo revision of the DC-7C to be powered by four Rolls-Royce Tyne engines. Two major U.S. airlines were, at the time of writing, understood to be interested in this model, which is currently known as the DC-7D.

The DC-7D will have strengthening modifications to the fuselage wings, tail and landing gear, a gross weight of 170,000



The Douglas DC-7C Long-Range Airliner.

lb. (77,180 kg.) and a payload capacity of 70,000 lb. (31,780 kg.). It is estimated by Douglas that the DC-7D will have direct operating costs 40 per cent. lower than those of existing four-engined piston-type aircraft.

A passenger version, which has been referred to as the DC-7T (and even as the DC-10), has also been investigated. With a 10-foot (3.05 m.) longer fuselage this would carry 86 passengers, and with Tyne 1 engines would cruise at 428 m.p.h. (685 km.h.) and have a maximum range of 2,086 miles (3,360 km.).

THE DOUGLAS DC-6.

TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23016-23012. Incidence at root 4°. Dihedral 7°. All-metal structure with smooth Alclad skin. NACA slotted flaps inboard of ailerons. Thermal de-icing.

FUSELAGE.—Semi-monocoque all-metal structure with flush-riveted Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Fin area 93.4 sq. ft. (8.67 m.²), Rudder area (aft of hinge, with tab) 49 sq. ft. (4.55 m.²), Total vertical area 159.9 sq. ft. (14.86 m.²), Tailplane area 210.9 sq. ft. (19.59 m.²), Elevator area (aft of hinge, with tab) 108.9 sq. ft. (10.11 m.²).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction with emergency manual gear. Hydraulic wheel brakes. Steerable nose wheel. Track 24 ft. 8 in. (7.52 m.). Wheel base 30 ft. 8 in. (9.34 m.).

POWER PLANT.—Four Pratt & Whitney Double-Wasp R-2800-CA15 eighteen-cylinder two-row radial air-cooled engines, each normally rated at 1,800 h.p. at 6,000 ft. (1,830 m.), 1,600 h.p. at 16,000 ft. (4,880 m.) and with a take-off output of 2,100 h.p. without or 2,400 h.p. with water injection. Hamilton Standard three-blade constant-speed full-feathering and reversible airscrews 13 ft. 1 in. (3.98 m.) diameter. Fuel capacity from 3,322 to 4,700 U.S. gallons (12,560 to 17,770 litres).

ACCOMMODATION.—Pressurised accommodation for crew and passengers. Passenger compartment seats 48 by day and for short-range can accommodate up to a maximum of 58. Entrance vestibule with coat-room and galley aft of wings with cabin space fore and aft. Upper and lower berths of 26 to 39 passengers may be fitted up in 30 seconds. Upper berths have separate air-conditioning controls. All berths have reading lights and storage space for clothing and toilet accessories. Men's lounge and toilet forward of main cabin, ladies' lounge, etc. aft of main cabin. Entire cabin space has fibre-glass sound-proofing and floors covered with foam-rubber-backed carpets. Pressurisation ensures cabin pressure altitude of approximately 5,000 ft. (1,525 m.) when flying at 16,000 ft. (4,880 m.), or 8,000 ft. (2,440 m.) when flying at 20,000 ft. (6,100 m.). Passenger cabin dimensions 64 ft. (19.5 m.) long 7 ft. 3 in. (2.2 m.) high. All freight and baggage space below cabin floor with new handling facilities to permit quick loading and unloading.

DIMENSIONS.—
Span 117 ft. 6 in. (35.81 m.).
Length 100 ft. 7 in. (30.66 m.).
Height (overall) 28 ft. 5 in. (8.66 m.).

WEIGHTS AND LOADINGS.—
Weight empty 51,495 lb. (23,380 kg.).
Weight loaded 97,200 lb. (44,130 kg.).
Wing loading 66.4 lb./sq. ft. (324 kg./m.²).
Power loading 10.1 lb./h.p. (4.58 kg./h.p.).

PERFORMANCE.—
Max. speed 356 m.p.h. (570 km.h.) at 19,600 ft. (5,980 m.).
Cruising speed 313 m.p.h. (501 km.h.) at 20,400 ft. (6,220 m.).
Landing speed 91 m.p.h. (145.6 km.h.).
Rate of climb at S/L. 1,070 ft./min. (326 m./min.).
Rate of climb at S/L. (one engine inoperative) 560 ft./min. (171 m./min.).
Normal range 3,820 miles (6,112 km.).
Max. range 4,610 miles (7,376 km.).
Take-off distance to 50 ft. (15.25 m.) S/L. (no wind) 1,240 yds. (1,133 m.).
Landing distance from 50 ft. (15.25 m.) 2,860 ft. (872 m.).
Landing distance from 50 ft. (15.25 m.) with reversible airscrews 2,150 ft. (656 m.).

THE DOUGLAS DC-6A.

U.S. Air Force designation: C-118.

U.S. Navy designation: R6D-1.

The DC-6A is a freight-carrying version of the standard DC-6. It uses the wings, tail-unit and landing-gear of the DC-6 but has an entirely new fuselage incorporating features which experience has shown to be necessary for successful military and commercial cargo operation.

The new fuselage is 5 ft. (1.525 m.) longer than that of the DC-6, giving the DC-6A a total cargo space of 5,000 cub. ft. (141.5 m.³). The main cabin, of constant cross-section throughout, is 68 ft. (20.74 m.) long, 7 ft. 9 in. (2.36 m.) high, and 8 ft. 9 in. (2.67 m.) wide at floor level. Two large doors, one forward and the other aft of the wings, are hinged at their top edges and swing upward to be clear of loading equipment. A self-powered loading elevator, which folds up for storage within the aircraft, can be attached to either front or rear cargo door and will lift 4,000 lb. (1,820 kg.) from truck-bed height to cabin floor level.

The DC-6A has automatically controlled cabin pressurisation and air-conditioning systems to permit high-altitude transportation of perishable cargoes.

Production of the military versions of the DC-6A—the C-118 and C-118A for the U.S.A.F. and the R6D-1 for the U.S. Navy—came to an end on December 29, 1955, after one C-118, 101 C-118A's and 65 R6D-1's had been delivered. These transports, which are in service with MATS and the U.S. Navy Fleet Logistic Air Wings, can carry 74 passengers, or 60 stretcher cases or 27,000 lb. (12,260 kg.) of cargo. The take-off weight is 107,000 lb. (48,530 kg.).

POWER PLANT.—Four Pratt & Whitney Double-Wasp R-2800-CB17 eighteen-cylinder radial air-cooled engines each developing 1,900 h.p. at max. continuous cruise and with 2,500 h.p. available for take-off with alcohol-water injection. Hamilton Standard or Curtiss Electric full-feathering and reversible airscrews. Standard fuel capacity 3,992 U.S. gallons (15,111 litres), with optional capacities of 5,406 U.S. gallons (20,550 litres) and 5,512 U.S. gallons (20,918 litres).

DIMENSIONS.—
As for DC-6 except Length 105 ft. 7 in. (32.20 m.).

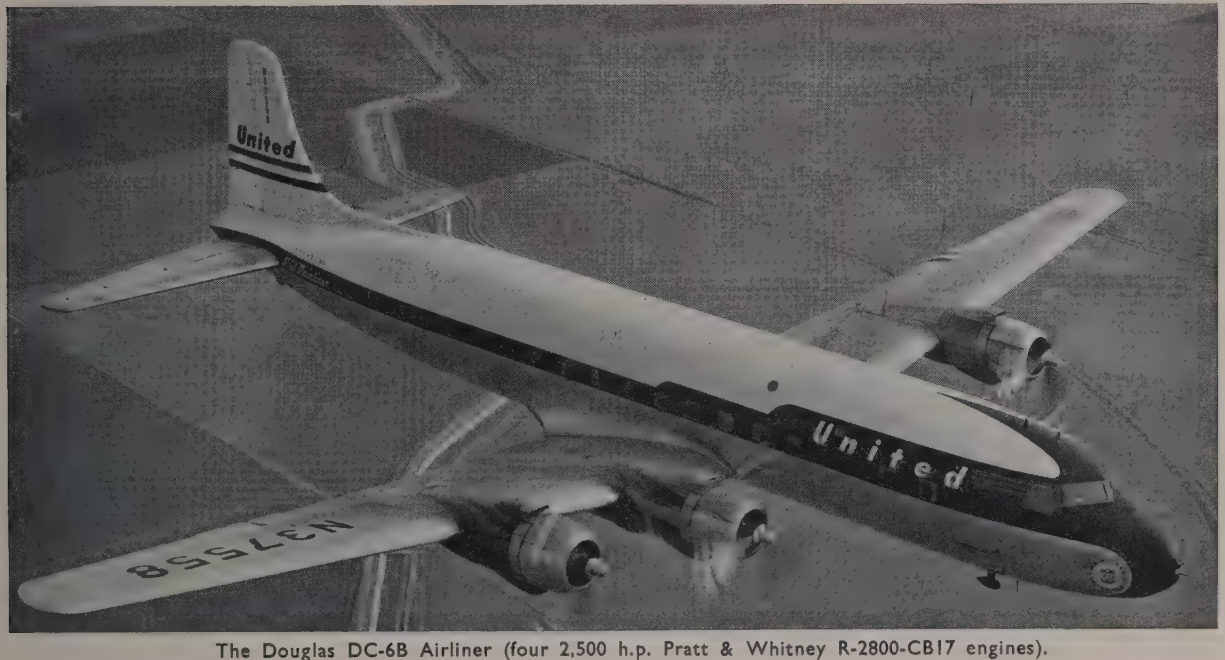
WEIGHTS AND LOADINGS.—
Weight empty 49,767 lb. (22,595 kg.).
Gross T.O. weight 106,000 lb. (48,125 kg.).
Wing loading 72.5 lb./sq. ft. (353.8 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

PERFORMANCE.—(At 95,000 lb.=42,800 kg. gross weight).—
Max. speed 360 m.p.h. (576 km.h.) at 18,100 ft. (5,520 m.).
Cruising speed 307 m.p.h. (494 km.h.) at 22,400 ft. (7,390 m.).
Landing speed 93 m.p.h. (149 km.h.).
Initial rate of climb 1,120 ft./min. (374 m./min.).
Initial rate of climb (one engine out) 620 ft./min. (203 m./min.).
T.O. distance to 50 ft. (15.25 m.) at max. A.U.W. (no wind) 4,500 ft. (1,492 m.).
Landing distance from 50 ft. (15.25 m.) 3,010 ft. (918 m.).
Landing distance from 50 ft. (15.25 m.) with reversible airscrews 2,250 ft. (686 m.).
Normal range 3,860 miles (6,176 km.).
Max. range 4,910 miles (7,856 km.).

THE DOUGLAS DC-6B.

The DC-6B is a passenger version of the DC-6A. The larger fuselage offers approximately 7% greater payload capacity and 14% greater passenger capacity than the standard DC-6, with only 4% greater operating costs.

The standard domestic dayplane version of the DC-6B carries 64 passengers, eight more than the standard DC-6, while a trans-oceanic model with larger



The Douglas DC-6B Airliner (four 2,500 h.p. Pratt & Whitney R-2800-CB17 engines).

galleys, coatrooms and toilet compartments carries 54 passengers instead of the present DC-6 limit of 48. A high-density 92-passenger version with an air-coach type interior is also available.

The DC-6B is available with either the Pratt & Whitney R-2800-CB17 or R-2800-CB16 power-plants. With the CB17 power-plant the maximum take-off weight is 106,000 lb. (48,125 kg.) and the performance is the same as for the DC-6A. With the CB16 power-plant which has 2,400 h.p. available for take-off, the maximum take-off weight is 100,000 lb. (45,400 kg.) and the corresponding take-off distance over a 50 ft. (15.25 m.) obstacle with no wind is 3,780 ft. (1,153 m.). The cruising and landing performance are the same as for the DC-6A. The empty weight of the standard DC-6B is 54,148 lb. (24,583 kg.) and the maximum landing weight is 88,200 lb. (40,043 kg.).

The version of the DC-6B supplied to Pan American World Airways has been specially modified for use on that operator's tourist class services. Pan American has acquired a fleet of forty-five aircraft of this type, which it calls the Super 6.

The Super 6, which has been certificated for a gross take-off weight of 107,000 lb. (48,580 kg.), carries a greater payload, has an increased fuel capacity and an improved performance. It has a standard accommodation for 82 passengers for trans-Atlantic tourist class operations.

FAIRCHILD

FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

EXECUTIVE OFFICE: HAGERSTOWN, MARYLAND.

Chairman of the Board: James A. Allis.

President: Richard S. Boutelle.

Vice-President and General Manager, Engine Division: George F. Chapline.

Vice-President and General Manager, Aircraft Division: Willard L. Landers.

Vice-President and General Manager, Stratos Division: F. E. Newbold, Jr.

Executive Vice-President, Comptroller A. F. Flood.

Vice-President: Paul J. Frizzell.

Secretary: Paul S. Cleaveland.

Treasurer: Floyd S. Bennett, Jr.

FAIRCHILD AIRCRAFT DIVISION

Divisional Office and Works: Hagerstown, Maryland.

General Manager: Willard L. Landers.

Assistant General Manager: O. A. Berthiaume.

Manager of Engineering: T. Beck.

Chief Engineer: Walter Tydon.

FAIRCHILD ENGINE DIVISION

DIVISIONAL OFFICE AND WORKS: DEER PARK, LONG ISLAND, N.Y.

General Manager: George F. Chapline.

Assistant General Manager: Evard M. Lester.

Chief Engineer: Alfred T. Gregory.

GUIDED MISSILES DIVISION

Divisional Office and Works: Wyandanch, Long Island, N.Y.

Vice-President and General Manager: Edwin A. Speakman.

STRATOS DIVISION

Divisional Office and Works: Bay Shore, Long Island, N.Y.

Vice-President and General Manager: F. E. Newbold, Jr.

Assistant General Manager: J. W. Livingston.

Chief Engineer: D. O. Moeller.

FAIRCHILD ELECTROTECHNICS DIVISION.

DIVISIONAL OFFICE AND WORKS: COSTA MESA, CALIFORNIA.

General Manager: Howard E. Roberts.

Development Project Director: E. E. Hardesty.

The Fairchild Engine and Airplane Corporation was formed in 1936 to acquire from the Fairchild Aviation Corporation its aeroplane and aero-engine manufacturing subsidiaries.

The company's Aircraft Division is engaged in the production of the Fairchild C-123B assault and logistics transport for the U.S. Air Force and is building the prototype of a new four-turboprop utility transport known as the Turboboxcar. It is also the largest of more than 2,000 sub-contractors on the Boeing B-52 production programme and is building two major fuselage sections, vertical tail fins and outer wing panels for this aircraft. A contract to modify nearly 100 Douglas B-26 medium bombers was completed early in 1957.

On the civil side, the Aircraft Division has been tooling up since 1956 to produce the Fokker F-27 Friendship turboprop airliner under licence, and the first production Fairchild-built F-27 will be delivered in late 1957 or early 1958.

Fairchild is also building a 10-seat four-jet executive transport known as the Model M-185.

The Fairchild Engine Division is engaged in research and development work for the U.S. Navy and Air Force. Several unique types of power-plant, most of them classified, are either in the production or in the experimental development stage.

The Guided Missiles Division is developing and producing guided missiles and missile guidance and launching systems for the Bureau of Aeronautics of the U.S. Navy. It also is producing missiles for the U.S. Air Force and U.S. Army.

The Stratos Division specializes in the design and production of pressurization and cooling equipment for aircraft. The division is producing in volume compact air cycle refrigeration units for use in high-speed jet aircraft.

THE FAIRCHILD M-185.

Designed as a high-speed executive aircraft, the ten-seat M-185 is a high swept-wing monoplane powered by four Fairchild J83 turbojet engines (2,000 lb. = 907 kg. s.t.) or General Electric J85 turbojet engines, mounted in podded pairs, one pair under each wing.

First flight of the prototype is scheduled for early 1958, with first production deliveries due in 1960. Orders for five had been received by the Spring of 1957, of which three were for the Continental Car Company.

DIMENSIONS (approx.).—
Span 57 ft. (17.37 m.).
Length 56 ft. (17.07 m.).

PERFORMANCE (estimated).—
Cruising speed 540 m.p.h. (870 km.h.).
Rate of climb, one engine out 1,700-3,000 ft./min. (520-915 m./min.).
Ceiling 45,000 ft. (13,700 m.).
Range with 1,900 U.S. gallons (7,190 litres) of fuel, against 80 m.p.h. (130 km.h.) headwind and with 30 min. reserve 2,650 miles (4,260 km.).

THE FAIRCHILD F-27.

Fairchild are manufacturing under licence in America the Fokker F-27 twin-turboprop airliner, with first deliveries scheduled for early 1958.

A full description of the Friendship appears under "Fokker" in the Netherlands section of this work, together with a combined list of all the orders received so far by both Fairchild and Fokker.

THE FAIRCHILD TURBOBOXCAR.

Fairchild is building the prototype of a new four-turboprop utility transport aircraft known as the Turboboxcar, as a successor to the C-119 Packet and C-123 assault transport. First flight is scheduled for mid-1958.

The Turboboxcar will be powered by four 1,600 e.h.p. Lycoming T55 turboprops, and may feature boundary layer control. It is intended for operation from small fields and from the decks of aircraft carriers for on-board delivery service.

WEIGHTS.—
Weight loaded 75,000 lb. (34,020 kg.).
Max. payload 32,181 lb. (14,603 kg.).

PERFORMANCE (estimated).—
Cruising speed 249 m.p.h. (400 km.h.).
Ceiling 25,000 ft. (7,620 m.).
Take-off distance to 50 ft. (15.25 m.) 2,240 ft. (683 m.).
Take-off distance to 50 ft. (15.25 m.) with boundary layer control 1,750 ft. (533 m.).
Landing distance from 50 ft. (15.25 m). 2,050 ft. (625 m.).
Landing distance from 50 ft. (15.25 m.) with boundary layer control 1,610 ft. (490 m.).
Range with 21,439 lb. (9,725 kg.) payload 1,500 miles (2,415 km.).

THE FAIRCHILD PACKET.

U.S. Air Force designation: C-119.
U.S. Marine Corps designation: R4Q.

The original design of the Packet was begun in 1941 and the design and mock-up were approved by the U.S. Army in 1942. The prototype, under the designation XC-82, first flew on September 10, 1944.

The C-82 was the first production version, but it went out of production in 1948 in favour of a new and improved version known as the C-119. This has been produced in the following versions:—

C-119B. Two Pratt & Whitney R-4360-20 twenty-four cylinder radial engines with two-stage blowers, rated at 2,650 h.p. to 6,000 ft. (1,830 m.), 2,300 h.p. at 18,000 ft. (5.480 m.) and with 3,250 h.p. available for take-off. First production version of C-119.

C-119C. Two Pratt & Whitney R-4360-20W engines developing 3,500 h.p.



The Fairchild C-119G Packet Military Transport (two 3,500 h.p. Wright R-3350 Turbo Compound engines).
(Gordon Williams).



The Fairchild R4Q-2 Marine Corps Transport, which is identical to the C-119F.

for take-off. Dorsal fins added to booms.

R4Q-1. U.S. Marine Corps version of C-119C. The two versions are identical.

C-119F. Similar to C-119C but fitted with two 3,500 h.p. Wright R-3350-85 Turbo Compound engines and Hamilton Standard airscrews. Small lower fins added.

R4Q-2. U.S. Marine Corps version of C-119F.

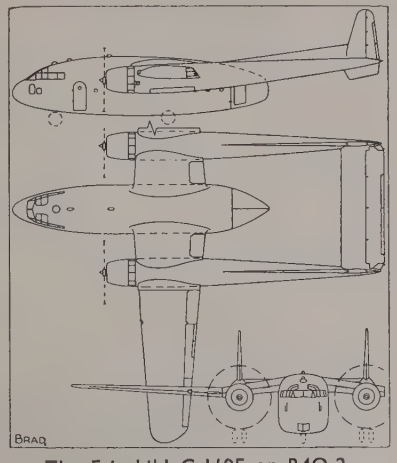
C-119G. As C-119F but with Aero-Products airscrews. First production C-119G flew on October 28, 1952.

The last production C-119, the 1,112th of the type, was built towards the end of 1955.

A full structural description of the C-119 has appeared in earlier editions of "All the World's Aircraft."

TYPE.—Twin-engined Cargo and Troop Transport.

ACCOMMODATION.—Flight deck has two seats side-by-side for pilot (on port) and co-pilot; navigator's seat and table are on starboard side of the aircraft; the radio operator is centrally located behind the pilot and co-pilot. A crew chief's seat is provided behind the pilot over the entrance hatch. Individual oxygen equipment for all members of crew. Access to the flight deck is by a ladder on the port side. The aircraft is equipped as a troop transport, ambulance or medium cargo transport. An electrically-operated monorail discharges paracans through a hatch in the bottom of the fuselage. Ramps provided to load wheeled or tracked equipment. Heavy reinforced floors are at truck bed level. Rear cargo doors open on vertical hinge line providing entrance opening as wide and high as cargo hold. Small door in each main cargo door for simultaneous jumping of two sticks of paratroopers. Interior dimensions of cabin or hold: Length 36 ft. 11 in. (11.25 m.). Width 9 ft. 10 in. (3.0 m.). Height 8 ft. (2.44 m.). Floor area 353 sq. ft. (32.8 m.²). Volume 3,150 cub. ft. (88.2 m.³). Normal seating capacity 67. Maximum seating capacity (emergency evacuation) 78. Stretcher patients 35. Monorail capacity 20 bundles each weighing 500 lb. (227 kg.). Glider tow capacity one 30,000 lb. (13,620 kg.) glider.



The Fairchild C-119F or R4Q-2.

DIMENSIONS.—
Span 109 ft. 3 in. (33.32 m.).
Length 86 ft. 6 in. (26.38 m.).
Height 26 ft. 3 in. (8.0 m.).

WEIGHTS AND LOADINGS (C-119C).—
Weight empty 39,942 lb. (18,134 kg.).
Payload 27,500 lb. (12,485 kg.).
Max. T.O. weight 73,150 lb. (33,210 kg.).
Wing loading 50.5 lb./sq. ft. (246.4 kg./m.²).
Power loading 10.5 lb./h.p. (4.76 kg./h.p.)

WEIGHTS AND LOADINGS (C-119F).—
Weight empty 39,809 lb. (18,083 kg.).
Payload 28,000 lb. (12,712 kg.).
Max. T.O. weight 72,800 lb. (33,050 kg.).
Wing loading 50.5 lb./sq. ft. (246.4 kg./m.²).
Power loading 10.5 lb./h.p. (4.76 kg./h.p.).

WEIGHTS AND LOADINGS (C-119G).—
Weight empty 39,982 lb. (18,152 kg.).
Payload 28,000 lb. (12,712 kg.).
Max. T.O. weight 74,400 lb. (33,778 kg.).
Wing loading 51.4 lb./sq. ft. (250.8 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

PERFORMANCE (C-119C—2 × Pratt & Whitney R-4360-20W engines).—
Cruising speed at 70% normal rated power 200 m.p.h. (320 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 740 ft./min. (226 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 1,950 miles (3,120 km.).

PERFORMANCE (C-119F—2 × Wright R-3350-85 engines).—
Cruising speed at 70% normal rated power 205 m.p.h. (328 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 820 ft./min. (250 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,300 miles (3,680 km.).

PERFORMANCE (C-119G—2 × Wright R-3350-89W engines).—
Cruising speed at 70% normal rated power 200 m.p.h. (320 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 750 ft./min. (230 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,280 miles (3,648 km.).



The Fairchild C-123B Provider Military Transport (two 2,500 h.p. Pratt & Whitney R-2800 engines).

THE FAIRCHILD PROVIDER.
U.S.A.F. designation: C-123B.

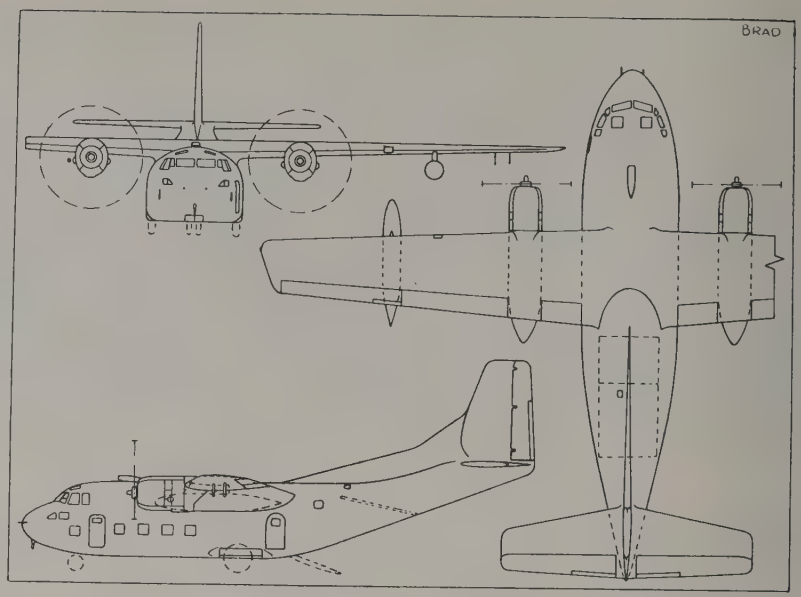
The C-123 was designed by the original Chase Aircraft Company, Inc. A production order for 300 C-123B's held by the Kaiser-Frazer Corporation, which had acquired a majority interest in the Chase company in 1953, was cancelled in June of that year. New bids were asked for, as the result of which production of the C-123B was assigned to Fairchild. The first Fairchild-built C-123B flew for the first time on September 1, 1954, and production aircraft entered service with the U.S.A.F.'s 309th Troop Carrier Group in July, 1955.

Orders totalling 300 aircraft were expected to keep the C-123B in production through 1958.

An interesting design feature is that all fuel is carried in jettisonable tanks to reduce fire risk in combat.

The prototype C-123B has been fitted experimentally with two Fairchild J44 turbojet engines (1,000 lb.=454 kg. s.t. each) mounted at the wing-tips to provide auxiliary power for use in emergency, particularly in the event of failure of one engine on take-off. In tests the C-123B, loaded to its gross all-up weight and with one engine feathered during take-off, showed an increase in rate of climb of from 150 ft./min. to 500 ft./min. with the jet augmenters in operation. The jet-augmented C-123B, which is a private research project, first flew on February 7, 1955.

Another C-123B has been fitted with a newly-developed wheel/ski landing gear, on which it has taken off and landed successfully at a loaded weight of approximately 56,000 lb. (25,400 kg.).



The Fairchild C-123B Provider.

TYPE.—Twin-engined Troop and Cargo-carrying Transport for operation from short or unprepared landing fields.

WINGS.—High-wing cantilever monoplane. Aspect ratio 9.89. All metal structure. Flaps inboard of ailerons and divided by tail cones of engine nacelles. Aileron area 83.28 sq. ft. (7.73 m.²), flap area 128.00 sq. ft. (11.89 m.²), gross wing area 1,223.22 sq. ft. (113.64 m.²).

FUSELAGE.—The main fuselage frame is of stressed-skin monocoque construction. The nose is of truss-type welded steel tubing to provide maximum crash protection for flight personnel.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with fabric-covered control surfaces. Trim-tabs in elevators and rudder. Total horizontal tail area 345.5 sq. ft. (32.09 m.²), fin area 127.5 sq. ft. (11.84 m.²) plus dorsal fin 68.3 sq. ft. (6.34 m.²), elevator area 127.8 sq. ft. (11.85 m.²), rudder area 59.19 sq. ft. (5.59 m.²). Tailplane span 39 ft. 2 in. (11.94 m.).

LANDING GEAR.—Retractable tricycle type. Main gear retracts up into fuselage and is completely enclosed when retracted. A high-strength drag link is incorporated to carry drag loads and side loads from the gear to increase the utility of the aircraft for rough field operation. The dual wheel nose wheel unit is also completely retractable. Goodyear wheels of removable-flange type and Goodyear brakes with Westinghouse Decelostat anti-skid equipment. Wheelbase 23 ft. 11 in. (7.3 m.). Track 12 ft. 1 in. (3.69 m.).

POWER PLANT.—Two 2,500 h.p. Pratt & Whitney R-2800-99W radial air-cooled engines driving Hamilton Standard three-blade steel constant-speed feathering and reversing airscrews. Jettisonable self-sealing fuel tanks installed in nacelles. Total internal fuel capacity 1,462 U.S. gallons (5,520 litres). Provision for two auxiliary drop tanks, 450 U.S. gallons (1,700 litres) each. The power-plant installation is such that a complete engine change forward of the fire-wall, may be made in 45 minutes. Quick disconnect fittings are provided in all lines and mechanisms to facilitate the operation.

ACCOMMODATION.—Flight compartment in nose, seats crew of two. Cargo compartment 36 ft. 8 in. (11.18 m.) long, 9 ft. 2 in. (2.79 m.) wide and 8 ft. 2 in. (2.48 m.) high with a usable floor area of 450 sq. ft. (41.8 m.²) and cubic capacity of 3,570 cub. ft. (100 m.³). The compartment floor is stressed to support distributed loads of 250 lb./sq. ft. (1,220 kg./m.²) and two tread-ways accommodate vehicles with loadings up to 6,500 lb. (3,405 kg.) per wheel. Tie-down fittings are spaced over total floor area on a 20 in. (50.8 cm.) grid pattern, each fitting capable of sustaining a 10,000 lb. (4,535 kg.) load in any direction. The large rear loading door is formed by lowering the rear sloping wall of the hold to form a ramp and an upper door which folds inside fuselage to give adequate clearance for vehicles, bulky freight, etc. Ramp is hydraulically operated. Compartment can receive a 155 mm. howitzer and one truck or any comparable combination of wheeled units. As a personnel carrier, plane can accommodate 60 fully-equipped troops, 50 stretcher patients, plus 6 sitting patients and 6 medical attendants. Personnel can enter by side doors which may also be used for parachute jumping.

DIMENSIONS.—
Span 110 ft. (33.55 m.).
Length 76 ft. 3 in. (23.25 m.).
Height 34 ft. 1 in. (10.38 m.).

WEIGHTS AND LOADINGS.—
Weight empty 31,058 lb. (14,100 kg.).
Max. gross weight 60,000 lb. (27,240 kg.).
Wing loading 49.0 lb./sq. ft. (239.12 kg./m.²).
Power loading at max. A.U.W. 12.0 lb./h.p. (5.44 kg./h.p.).

PERFORMANCE.—
Max. speed 245 m.p.h. (392 km.h.).
Cruising speed (at 61% power) 190 m.p.h. (304 km.h.).
Stalling speed 75 m.p.h. (120 km.h.).
Rate of climb 1,150 ft./min. (350 m./min.).
Service ceiling 23,000 ft. (7,015 m.).
Range with max. cargo and optimum cruising speed at 5,000 ft. (1,525 m.) 1,470 miles (2,350 km.).

FLETCHER
FLETCHER AVIATION CORPORATION.
HEAD OFFICE AND WORKS: FLETCHER AIRPORT, ROSEMEAD, CALIFORNIA.
President: Wendell S. Fletcher.
Vice-President: H. E. Fletcher.
Legal Counsel: Leland C. Launer.
Secretary: Maurice C. Fletcher.
Treasurer: D. V. Nelson.

The Fletcher Aviation Corpn. entered the aircraft manufacturing field in 1941. Its first post-war aircraft was the FL-23 military liaison monoplane, followed by the FD-25 lightweight ground support aircraft. The most recent version is the FD-25-B, a licence for which is held by the Toyo Aircraft Company of Tokyo, Japan. It has been described in detail in earlier editions of "All the World's Aircraft."

The latest product of the company is the FU-24 general utility monoplane, of which 100 are being assembled in New Zealand for agricultural top-dressing work.

The Fletcher Aviation Corporation has also established itself as the foremost producer of jettisonable fuel tanks in America. Over 250,000 fuel and napalm tanks, ranging in size from 40 to 1,700 U.S. gallons (150-6,432 litres), have been produced and delivered to the U.S. Air Forces under prime contracts.

THE FLETCHER FU-24 "UTILITY."

The FU-24 was designed primarily for agricultural top-dressing work in New Zealand, where 100 are being assembled. The prototype flew in July, 1954, followed by the first production aircraft five months later.

TYPE.—General Utility monoplane developed primarily for agricultural uses.

WINGS.—Low-wing cantilever monoplane. NACA 4415 wing section. Aspect ratio 6. Chord 7 ft. (2.13 m.). Dihedral (outer wings) 8°. Incidence +2°. All-metal two-spar double-celled structure. All-metal slotted flaps. All-metal plain-hinge ailerons. Total flap area 34 sq. ft. (3.16 m.²). Total aileron area 20 sq. ft. (1.86 m.²). Gross wing area 294 sq. ft. (27.31 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever all-metal structure. All-movable horizontal tail with anti-servo-tab. Areas: fin 13.6 sq. ft. (1.26 m.²), rudder 6.9 sq. ft. (0.64 m.²), tailplane 43.1 sq. ft. (4.00 m.²), servo tab 4.9 sq. ft. (0.45 m.²). Tailplane span 13 ft. 9½ in. (4.2 m.).

LANDING GEAR.—Fixed nose-wheel type. Fletcher air-oil shock-absorber struts. Goodrich wheels and tyres. Goodrich hydraulic expander tube brakes on main wheels. Track 12 ft. 2 in. (3.71 m.). Wheelbase 7 ft. 6 in. (2.28 m.).

POWER PLANT.—One 225 h.p. Continental O-470-E or 240 h.p. Continental O-470-N six-cylinder horizontally-opposed air-cooled engine. Hartzell two-blade constant speed metal airscrew. Two fuel tanks (22 U.S. gallons each) one in each wing. Total fuel capacity 44 U.S. gallons (166 litres). Oil capacity 12 U.S. quarts (11.4 litres).

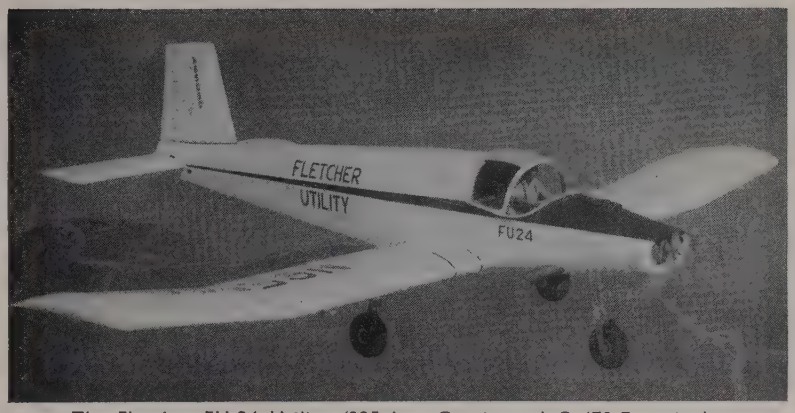
ACCOMMODATION.—Closed cockpit for pilot over leading-edge of wings. Compartment for four passengers or cargo aft of cockpit.

DIMENSIONS.—
Span 42 ft. (12.81 m.).
Length 31 ft. 10 in. (9.69 m.).
Height 10 ft. 4 in. (3.14 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,870 lb. (848 kg.).
Pilot 170 lb. (77 kg.).
Fuel (20 U.S. gallons) and oil 143 lb. (65 kg.)
Payload 1,317 lb. (597 kg.).
Total disposable load 1,630 lb. (740 kg.).
Weight loaded 3,500 lb. (1,588 kg.).
Wing loading 11.9 lb./sq. ft. (58.07 kg./m.²).
Power loading (O-470-E engine) 15.5 lb./h.p. (7.03 kg./h.p.).
Power loading (O-470-N engine) 14.6 lb./h.p. (6.62 kg./h.p.).

PERFORMANCE (Continental O-470-E engine, at 3,500 lb.=1,590 kg. A.U.W.).—
Max. speed at S/L. 131 m.p.h. (211 km.h.).
Cruising speed 111 m.p.h. (179 km.h.).
Min. speed (flaps up, power off) 56 m.p.h. (89.6 km.h.).
Min. speed (flaps down, power off) 48 m.p.h. (77.2 km.h.).
Min. speed (flaps down, power on) 42 m.p.h. (67.2 km.h.).
Rate of climb at S/L. 625 ft./min. (190 m./min.).
Service ceiling 12,800 ft. (3,900 m.).
Cruising range (40 U.S. gallons) 370 miles (592 km.).
Cruising endurance (40 U.S. gallons) 3.3 hours.
Take-off to clear 50 ft. (15.25 m.), off grass 1,075 ft. (325 m.).

PERFORMANCE (Continental O-470-N engine, at 3,500 lb.=1,590 kg. A.U.W.).—
Rate of climb at S/L. 745 ft./min. (227 m./min.).
Service ceiling 14,780 ft. (4,500 m.).
Take-off to clear 50 ft. (15.25 m.), off grass 1,000 ft. (305 m.).



The Fletcher FU-24 Utility (225 h.p. Continental O-470-E engine).

FORNEY

FORNEY MANUFACTURING COMPANY. Aviation Division.

HEAD OFFICE AND WORKS: FORT COLLINS, COLORADO.

In April, 1955 the Forney Manufacturing Company purchased the manufacturing rights for the Ercoupe light aeroplane, the original version of which was designed and marketed in 1940 by the Engineering and Research Corporation of Riverdale, Maryland.

In its original form, the Ercoupe incorporated a control system which eliminated the need for rudder pedals, the aeroplane being flown entirely by a control wheel. This version, known as the Ercoupe Model 415C went out of production when America entered the war, and when production was resumed post-war, the improved Ercoupe Model G Club-Air was offered with optional two-control or standard three-control system. Details of both versions have appeared in earlier editions of "All the World's Aircraft."

THE FORNEY F-1 AIRCOUPE.

The Forney Aircoupe is basically similar to the Ercoupe Model G Club-Air, which went out of production in 1951, but incorporates many detail improvements, in addition to a more powerful engine. The prototype Aircoupe made its first flight on February 18, 1956, and the type is now in production.



A drawing of the Forney Aircoupe (90 h.p. Continental C90 engine).

TYPE.—Two-seat Light monoplane.
WINGS.—Cantilever low-wing monoplane. Wing section NACA 43013. Aspect ratio 6.31. Chord 5 ft. (1.52 m.). Dihedral 7°. Incidence 3½°. Aluminium structure. Aluminium ailerons with total area of 16.8 sq. ft. (1.56 m.²). No flaps. Gross wing area 142.6 sq. ft. (13.2 m.).
FUSELAGE.—All-metal monocoque structure.
TAIL UNIT.—Cantilever monoplane type, with twin fins and rudders. All metal structure with metal covering throughout. Areas: fins 1.35 sq. ft. (0.124 m.²), rudder 2.70 sq. ft. (0.25 m.²), elevators 9.4 sq. ft. (0.87 m.²), tailplane 8.2 sq. ft. (0.76 m.²). Tailplane span 8 ft. 6 in. (2.59 m.).
LANDING GEAR.—Fixed tricycle type, with Forney rubber disc-oil shock-absorbers. Goodyear 600 × 16 wheels and disc brakes. Wheel track 7 ft. 5 in. (2.26 m.). Wheelbase 5 ft. (1.52 m.).
POWER PLANT.—One 90 h.p. Continental C90 12F four-cylinder horizontally-opposed air-cooled engine driving a McCauley two-blade fixed-pitch metal airscrew. Fuel in two wing tanks each of 9 U.S. gallons (34 litres) capacity and one fuselage tank of 6 U.S. gallons (22.7 litres) capacity. Total fuel capacity 24 U.S. gallons (90.7 litres). Oil capacity 5 U.S. quarts (4.5 litres).
ACCOMMODATION.—Enclosed cabin seating two side-by-side with space behind for an extra seat suitable for a child weighing up to 75 lb. (34 kg.), or for 75 lb. (34 kg.) baggage.
DIMENSIONS.—
Span 30 ft. (9.14 m.).
Length 20 ft. 2 in. (6.15 m.).
Height 6 ft. 3 in. (1.90 m.).
WEIGHTS.—
Weight empty 890 lb. (404 kg.).
Weight loaded 1,400 lb. (635 kg.).
PERFORMANCE.—
Cruising speed 120 m.p.h. (193 km.h.).
Stalling speed 56 m.p.h. (90 km.h.).
Service ceiling 15,500 ft. (4,725 m.).
Absolute ceiling 18,000 ft. (5,485 m.).
Take-off distance 500 ft. (153 m.).
Landing distance 600 ft. (183 m.).
Range 500 miles (805 km.).

FRYE

THE FRYE CORPORATION.

HEAD OFFICE AND WORKS: POST OFFICE BOX 1375, FORT WORTH, TEXAS.

President: Jack Frye.

Vice-President and Secretary-Treasurer: Francis H. McKillip.

Vice-President, Engineering: Joe H. Talley.

Vice-President, Sales: Don M. Marshall.

The Frye Corporation was formed in 1955 by Mr. Jack Frye, former president of Trans World Airlines, to design and market a cargo-passenger transport to replace the DC-3 for short-haul operations.

Engineering and development work on the prototype of this aircraft, known as the F-1 Safari, is being carried out at Fort Worth under the supervision of Mr. Frye.

Production of the F-1 Safari will be handled under licence by an existing manufacturer. Details are given hereafter.

THE FRYE F-1 SAFARI.

Intended as a DC-3 replacement, the Safari will be available in four different versions; all-passenger, all-cargo, mixed cargo-passenger and executive-utility.

The design emphasis is on low take-off, approach and landing speeds, combined with heavy-duty landing-gear and light tyre loadings to permit safe operation from comparatively small unsurfaced fields. Standard power plants will be 800 h.p. Wright Cyclone engines, but it will be possible to install either Alvis Leonides Major 14-cylinder air-cooled radials or Lycoming T53 turboprops without conversion of the engine nacelles aft of the firewall. The design will be readily adaptable to boundary-layer control systems in the future.

At the time of writing, orders for the F-1 Safari had been received from Northern Consolidated Airlines (Alaska) 3, Wien Alaska Airlines 3, Catalina Airlines (U.S.A.) 2, Cruzeiro do Sul (Brazil) 10, and Samoan Airlines 6. It was stated that options had been taken on about 40 more.

The prototype Safari is scheduled to fly in May, 1958 and the first production aircraft late in the same year.

TYPE.—Four-engined Cargo-Passenger Transport.
WINGS.—Cantilever high-wing monoplane. Wing section NACA 23018 at root, NACA 23015 at tip. Aspect ratio 8. Chord (theoretical) 17 ft. 1⅛ in. (5.22 m.) at root, 10 ft. 3¼ in. (3.13 m.) at tip. No dihedral. Incidence 5° at root, 3° at tip. All-metal structure with alclad skin. Ailerons have all-metal structure with fabric covering. Double-slotted flaps, metal-covered. Total area of ailerons 94.64 sq. ft. (8.79 m.²) aft of hinge line. Total area of flaps 224 sq.

ft. (20.80 m.²). Gross wing area 1,500 sq. ft. (139.35 m.²).

FUSELAGE. — Semi-monocoque all-metal structure with alclad skin.

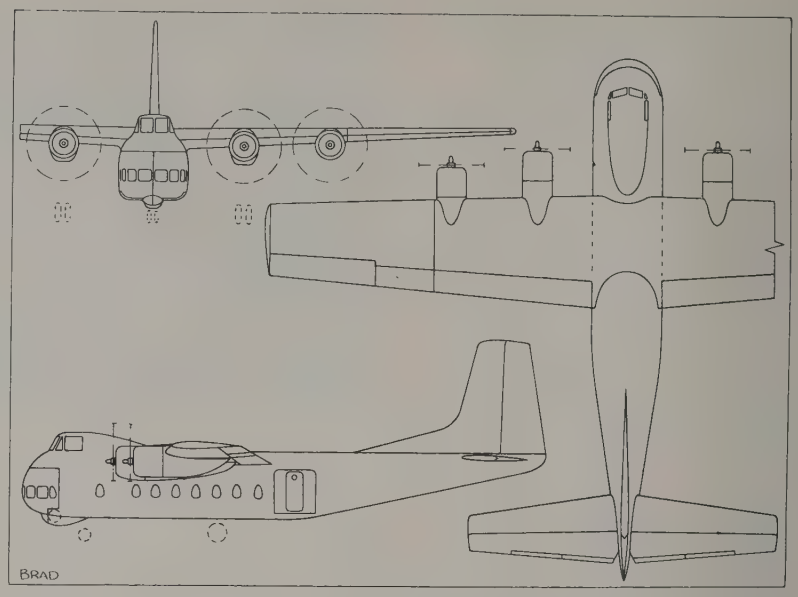
TAIL UNIT.—Cantilever monoplane type. All-metal tailplane. Elevator fabric-covered. Areas: fin 129.91 sq. ft. (12.07 m.²), rudder 66.85 sq. ft. (6.21 m.²) aft of hinge line, including tabs, elevators 131.25 sq. ft. (12.20 m.²), tailplane 243.75 sq. ft. (22.65 m.²). Tailplane span 46 ft. 5½ in. (14.16 m.).

LANDING GEAR.—Retractable tricycle type. Oleo-pneumatic shock-absorbers. Hydraulic retraction. Dual wheels on nose and main units. Dual hydraulic brakes. Wheel track 24 ft. 2 in. (7.37 m.). Wheelbase 23 ft. 5¼ in. (7.15 m.).

POWER PLANT.—Normally four Wright Cyclone Model 957C7BA1 seven-cylinder radial air-cooled engines, rated at 800 h.p. for take-off, and with 700 h.p. maximum continuous power and 490 h.p. available for cruising. Hamilton-Standard three-blade constant-speed fully-feathering airscrews, diameter 13 ft. 6 in. (4.11 m.). Alternatively, can have four 820 h.p. Alvis Leonides Major or four 825 e.s.h.p. Lycoming T53-L-1 turboprop engines. Two separate fuel tanks in each wing, each with capacity of 325 U.S. gallons (1,232 litres). Total fuel capacity 1,300 U.S. gallons (4,928 litres). Oil capacity 15 U.S. gallons (56.8 litres) per engine.

ACCOMMODATION.—Cargo version with clam-shell nose loading doors has 2,252.6 cub. ft. (63.79 m.³) of cargo space. Passenger version accommodates 56 persons with 39 in. (0.99 m.) pitch seating, or 66 persons with 35 in. (0.89 m.) pitch seating, or 75 persons in "coach" configuration. Fifty of the seats are standardised units, and six take the form of a semi-circular "Vistaramic" lounge seat behind windows in the nose of the cabin. Accommodation in the passenger-cargo version is dependent on the ratio of each to be carried. Specially-designed furnishings are available for the executive-utility version.

DIMENSIONS.—
Span 109 ft. 6 in. (32.87 m.).



The Frye F-1 Safari Transport.

Length 79 ft. 6 in. (24.23 m.).
Height 30 ft. 0 in. (9.14 m.).

WEIGHTS AND LOADINGS.—
Weight empty (cargo version) 24,355 lb. (11,047 kg.).
Weight empty (passenger version) 27,920 lb. (12,665 kg.).
Weight loaded 45,000 lb. (20,410 kg.).
Wing loading 30 lb./sq. ft. (146.5 kg./m.²).
Power loading 14.06 lb./h.p. (6.38 kg./h.p.).

PERFORMANCE (estimated).—
Max. speed at 8,000 ft. (2,440 m.) 217 m.p.h. (349 km.h.).
Cruising speed at max. cruising power at 8,000 ft. (2,440 m.) 187 m.p.h. (301 km.h.).
Stalling speed (flaps down) 68.5 m.p.h. (110 km.h.).
Rate of climb at S/L. 920 ft./min. (280 m./min.).
Rate of climb at S/L. (1 outer engine inoperative) 520 ft./min. (160 m./min.).
Range at max. cruising power at 8,000 ft. (2,440 m.) 1,520 miles (2,446 km.).
Max. range at 152 m.p.h. (245 km.h.) 1,855 miles (2,985 km.).
C.A.A. airport runway length at S/L. for take-off 3,200 ft. (975 m.).
C.A.A. airport runway length at S/L. for landing 2,780 ft. (850 m.).

GAIL

GAIL AIRCRAFT ENGINEERING COMPANY.

HEAD OFFICE AND WORKS: MUNICIPAL AIRPORT, SACRAMENTO, CALIFORNIA.

This company has built the prototype of an agricultural aircraft known as the Gail Model 202 Mantis, which follows the lines of the pre-war Security Airster/Kinner Sportster series of braced low-wing monoplanes. It flew for the first time on May 30, 1956, and is described hereafter.

THE GAIL MODEL 202 MANTIS.

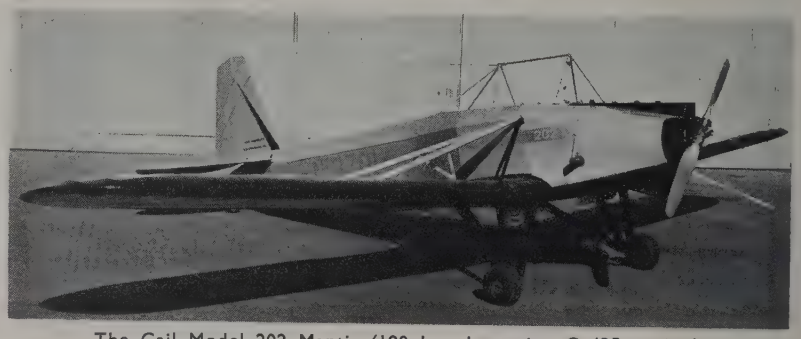
TYPE.—Single-seat Agricultural aircraft.

WINGS.—Braced low-wing monoplane. Clark Y wing section. Aspect ratio 6.6. Mean chord 6 ft. 0 in. (1.83 m.). Dihedral 4½°. Incidence 0°. Wood structure, fabric-covered. Multiple streamlined bracing struts. Wings fold back to lie alongside fuselage. Wooden ailerons with fabric covering. No flaps. Total area of ailerons 20.25 sq. ft. (1.88 m.²). Gross wing area 222 sq. ft. (20.6 m.²).

FUSELAGE.—Steel-tube structure with fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Steel-tube structure with fabric covering. Areas: fin 7.2 sq. ft. (0.67 m.²), rudder 10.25 sq. ft. (0.95 m.²), tailplane 18.6 sq. ft. (1.73 m.²), elevators 13.9 sq. ft. (1.29 m.²). Tailplane span 12 ft. (3.66 m.).

LANDING GEAR.—Non-retractable tail-wheel type. Dual spring plunger shock-absorbers. Goodyear wheels and single disc brakes.



The Gail Model 202 Mantis (190 h.p. Lycoming O-435 engine).

Wheel track 9 ft. 2 in. (2.79 m.). Wheelbase 18 ft. (5.49 m.).

POWER PLANT.—One Lycoming O-435-1 six-cylinder horizontally-opposed air-cooled engine, rated at 190 h.p. at 2,550 r.p.m. Two-blade Sensenich 85RB53 wooden fixed-pitch airscrew. One 25 U.S. gallon (94.5 litre) fuel tank in nose of fuselage. Oil capacity 3 U.S. gallons (11.4 litres).

ACCOMMODATION.—Single seat in open cockpit under tubular steel over-turn structure.

EQUIPMENT.—Agricultural dispenser suitable for liquid, dust and seed dispersal in fuselage.

DIMENSIONS.—
Span 40 ft. (12.19 m.).
Length 24 ft. 10 in. (7.57 m.).
Height 9 ft. 5 in. (2.87 m.).
Width folded 12 ft. (3.66 m.).

WEIGHTS AND LOADINGS.—
Useful load 1,315 lb. (596 kg.).
Max. payload 1,000 lb. (454 kg.).
Weight loaded 2,600 lb. (1,179 kg.).
Wing loading 11.7 lb./sq. ft. (57.2 kg./m.²).
Power loading 13.7 lb./h.p. (6.2 kg./h.p.).

PERFORMANCE.—
Max. speed 105 m.p.h. (169 km.h.).
Normal cruising speed 90 m.p.h. (145 km.h.).
Economical cruising speed 80 m.p.h. (129 km.h.).
Landing speed 45 m.p.h. (72.5 km.h.).
Rate of climb at S/L. (max. payload) 600 ft./min. (185 m./min.).

GOODYEAR

THE GOODYEAR AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: AKRON 15, OHIO.

The Goodyear Aircraft Corporation, known primarily as a builder of airships, although the company did manufacture complete aircraft during the last war and is still engaged in important sub-contract work for other aircraft manufacturers, has now entered the light helicopter field.

The first Goodyear helicopter, the "Project 400" or Model GA-400R, was designed by the Goodyear Aircraft Corporation, built by the Goodyear Tire and Rubber Company subsidiary and was flown for the first time at the company's airport at Wingfoot Lake, Akron, Ohio, on May 9, 1954.

The company has, more recently, used its experience of airship design and manufacture to produce inflatable fabric rotor blades for helicopters and a light-plane with inflatable fuselage and wing. Details of this aircraft are given hereafter.

THE GOODYEAR GA-447 INFLATOPLANE.

The Goodyear Inflatoplane is a single-seat light aircraft with a pneumatic airframe. Cockpit, wing and tail assembly are made of Airmat, which consists of two walls of rubberised fabric connected by nylon threads. The fuselage is of simple rubberised fabric. The entire aircraft can be carried in the rear of an estate wagon and inflated with a domestic vacuum cleaner.

The original prototype, flown in 1956, has been followed by an improved version with enclosed cockpit, of which ten are being built for the U.S. Office of Naval Research. One will be a two-seater.

The Inflatoplane is powered by a 44 h.p. Nelson H-59A four-cylinder horizontally-opposed air-cooled two-stroke engine, mounted above the rear of the wing and driving a two-blade wooden tractor airscrew. Flying controls are conventional and the rigidity of the wing is such that it will support the weight of a man on each side immediately outboard of the bracing struts. Wing span is 34 ft. (10.36 m.) and a nose-wheel landing gear is used. Maximum speed is 60 m.p.h. (97 km.h.); empty weight approximately 200 lb. (91 kg.).



The Goodyear GA-447 Inflatoplane (44 h.p. Nelson H-59A engine).

THE GOODYEAR GA-400R-3 GIZMO.

The GA-400R-3, a one-man ultra-light helicopter, was designed to serve either as a courier-liaison or tactical vehicle. It has no military designation but has been demonstrated for various U.S. military agencies.



The Goodyear GA-400R-3 Gizmo Helicopter (38 h.p. Johnson 35 engine).

The airframe of welded aluminium tubing is supported by steel outrigger tubes and parallel aluminium tubular skids. Power is supplied by a Johnson 35 two-stroke engine which develops 38 h.p. at 5,000 r.p.m. and drives the main and anti-torque rotors through a belt and pulley arrangement. Fuel capacity is 4 U.S. gallons (15.2 litres).

The GA-400R-3 helicopter is still in the experimental stage and at the time of writing no structural details had been disclosed.

DIMENSIONS.—
Diameter of main rotor 20 ft. (6.10 m.).
Length 21 ft. (6.40 m.).
Height to top of rotor pylon 7 ft. 0½ in. (2.14 m.).

WEIGHTS.—
Normal loaded weight 490 lb. (222.5 kg).
Max. loaded weight 520 lb. (236 kg.).

PERFORMANCE.—
Max. speed 65 m.p.h. (104 km.h.).
Cruising speed 50 m.p.h. (80 km.h.).
Rate of climb 500 ft./min. (150 m./min.).
Hovering ceiling 6,000 ft. (1,830 m.).
Service ceiling (estimated) 12,000 ft. (3,660 m.).
Range with max. payload 50 miles (80 km).

GRUMMAN

GRUMMAN AIRCRAFT ENGINEERING CORPORATION.

HEAD OFFICE AND WORKS: BETHPAGE, LONG ISLAND, N.Y.

Incorporated: December 6, 1929.

Chairman of the Board: Leroy R. Grumman.

President: Leon A. Swirbul.

Senior Vice-President: William T. Schwendler.

Administrative Vice-President: E. Clinton Towl.

Vice-President: Robert L. Hall.

Vice-President, Manufacturing Engineering: William J. Hoffman.

Vice-President, Production: David Rittenhouse.

Vice-President, Contracts: George F. Titterton.

Vice-President and General Counsel: Charles Kingsley.

Secretary: Joseph A. Stamm.

Treasurer: Edmund W. Poor.

The Grumman Aircraft Engineering Corpn. continues to devote its principal activities to the construction and experimental development of aircraft for the U.S. Navy, although it is also developing a turboprop-powered executive transport named the Gulfstream and a twin-engined observation aircraft for the U.S. Army and Marine Corps.

The latest Grumman naval fighters of which details have been released are the supersonic F11F-1 Tiger light fighter and the swept-wing F9F-8 Cougar, which replaced the F9F-6 and F9F-7 in production in 1954. These aircraft are being built in the company's Peconic River factory in eastern Long Island.

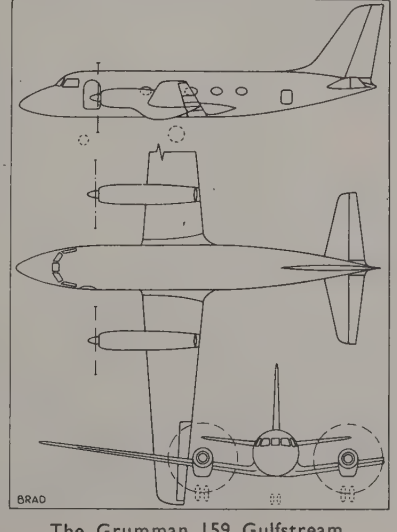
The S2F Tracker twin-engined anti-submarine aircraft is in production at the Bethpage plant, in two forms, the S2F-1 and S2F-2. There is also a general-utility/trainer version known as the TF-1 Trader and an early warning radar picket version, the WF-2 Tracer.

The Albatross is still being delivered in small numbers from Bethpage to the U.S.A.F., U.S. Navy and U.S. Coast Guard as an amphibian, the improved SA-16B version having flown for the first time on January 16, 1956.

After flight testing a French Fouga Magister jet trainer in America in 1956, Grumman took an option on producing both the C.M.170R and C.M.175 versions of this aircraft.

THE GRUMMAN 159 GULFSTREAM.

Grumman are building two prototypes of a 12-passenger pressurised light executive transport named the Gulfstream,



The Grumman 159 Gulfstream.

the first of which is scheduled to fly in May, 1958.

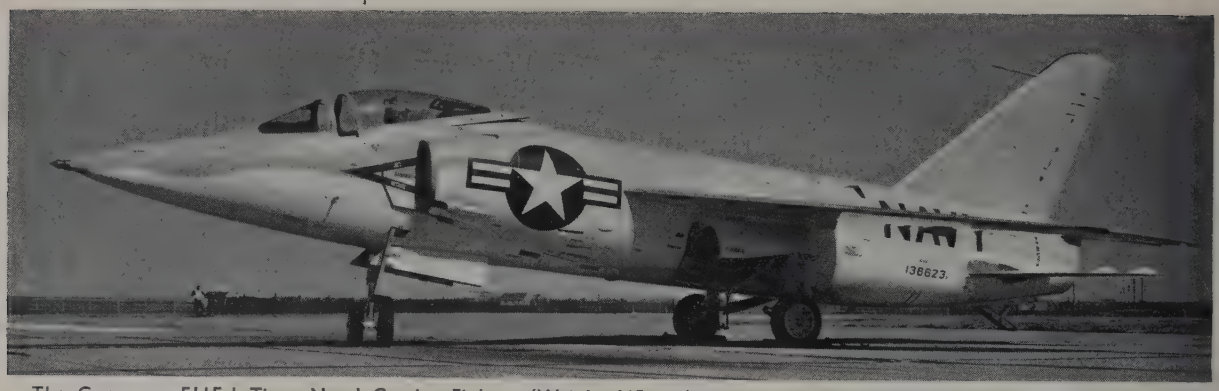
Of conventional all-metal low-wing monoplane design, the Gulfstream will be powered by two 2,105 e.h.p. Rolls-Royce Dart RDa. 7/2 turboprop engines, with provision for Darts of higher power when they become available. The engines will be mounted in high-set nacelles above the wing, and the twin-wheel main landing gear units will retract forward of the main wing spars to avoid cut-outs in the primary wing structure.

The Gulfstream will be offered for sale as a bare airframe, to be furnished and equipped by specialist contractors to the customer's specification. But the airframe will include integral passenger stairs and an auxiliary power unit for cabin air-conditioning while the aircraft is on the ground. The passenger cabin will be 31 ft 6 in. (9.60 m.) long and 6 ft. 1 in. (1.85 m.) high, and will accommodate 19 persons in the alternative high-density configuration. Normal fuel capacity will be 1,305 U.S. gallons (4,940 litres).

DIMENSIONS.—
Span 78 ft. 6 in. (23.92 m.).
Length 64 ft. 0 in. (19.51 m.).
Height 21 ft. 6 in. (6.55 m.).

WEIGHTS.—
Weight empty 12,000 lb. (5,443 kg.).
Basic operational weight 19,680 lb. (8,926 kg.).
Weight loaded 31,000 lb. (14,060 kg.).

PERFORMANCE (estimated).—
Recommended cruising speed at 25,000 ft. (7,620 m.) 345 m.p.h. (555 km.h.).
Rate of climb at S/L 2,300 ft./min. (700 m./min.).
Single-engine rate of climb at S/L 700 ft./min. (213 m./min.).
C.A.A. field length at S/L at max. A.U.W. 3,970 ft. (1,210 m.).
C.A.A. field length at S/L at 26,000 lb. (11,795 kg.) A.U.W. 3,000 ft. (915 m.).
C.A.A. field length at 5,000 ft. (1,525 m).



The Grumman F11F-1 Tiger Naval Carrier Fighter (Wright J65 turbojet engine with afterburner). (*Gordon Williams*).

altitude at max. A.U.W. 5,000 ft. (1,525 m.).

Max. stage length, including 230 mile (370 km.) diversion and 30 min. holding at 25,000 ft. (7,620 m.) 2,200 miles (3,540 km.).

Range with max. payload and reserves as above 1,840 miles (2,960 km.).

THE GRUMMAN MOHAWK.

U.S. Army name: Mohawk.
U.S. Marine Corps designation: OF-1.

Grumman are developing a high-performance observation aircraft for the U.S. Army, Navy and Marine Corps, the prototype of which is scheduled to fly in 1959. It will be powered by either two Lycoming T53 or two General Electric T58 turboprop engines, driving large-diameter airscrews, and is intended to combine a top speed of 350 m.p.h. (560 km.h.) with the ability to operate from short airfields.

THE GRUMMAN G-98 TIGER.

U.S. Navy designation: F11F.

Although it originally carried the basic F9F designation of the Cougar and Panther, the Tiger, which is a completely new design, has now been given the designation F11F.

The Tiger, which is capable of supersonic speeds in level flight, incorporates a number of design refinements which permit a reduction of weight and size without detracting from its service suitability. The most interesting design feature is the slight "waisting" of the fuselage amidships in the region where the wing joins the fuselage. This design feature, known as the "area rule," is claimed to ensure optimum drag characteristics at transonic speeds.

Three versions of the Tiger have been announced :—

F11F-1. Initial production version. Prototype flew on July 30, 1954, less than 15 months after receipt of Letter of Intent from Navy Bureau of Aeronautics. Six pre-production aircraft with Wright J65-W-6 turbojet and afterburner. Thirty-nine production aircraft ordered with J65-W-4 and afterburner, two of which have been modified to F11F-1F standard.

F11F-1F. Two F11F-1 aircraft modified with General Electric J79 turbojet and afterburner instead of J65. Enlarged air intakes and rear fuselage. Sweep-forward on inboard portions of wing leading edges. An F11F-1F is reported to have attained a speed of 1,220 m.p.h. (1,963 km.h.) and a height of over 72,000 ft. (21,950 m.) late in 1956.

F11F-1FT. Two-seat trainer version of F11F-1F. Fuselage lengthened by 12 in. (0.30 m.) A.U.W. reduced by 500 lb. (227 kg.).

The following details apply to the standard F11F-1 Tiger :—

TYPE.—Single-seat Naval Carrier Fighter.

WINGS.—Cantilever mid-wing monoplane. 30° leading-edge sweepback. 6.5% thickness/chord ratio. All-metal structure. One-piece machined upper and lower skins. Leading-edge slats. Trailing-edge flaps over whole of fixed portion of wings, the wing-tips being manually hinged for carrier stowage. Lateral control by spoilers. Small trim-tab outboard of port flap.

FUSELAGE.—All-metal structure. Finger-type air brakes on underside of fuselage in line with trailing-edge of wings.

TAIL UNIT.—All surfaces swept. Comprises fixed fin, rudder and low-mounted all-flying tailplane with slight dihedral.

LANDING GEAR.—Retractable tricycle type. All wheels retract into fuselage.

POWER PLANT.—One Wright J65-W-6 axial-flow turbojet engine (7,800 lb.=3,540 kg. s.t.) with afterburner. Fuel in integral wing tanks.

ACCOMMODATION.—Pressurised cockpit in nose. Ejector seat.

ARMAMENT.—Four 20 mm. cannon. Provision for air-to-air and air-to-ground missiles.

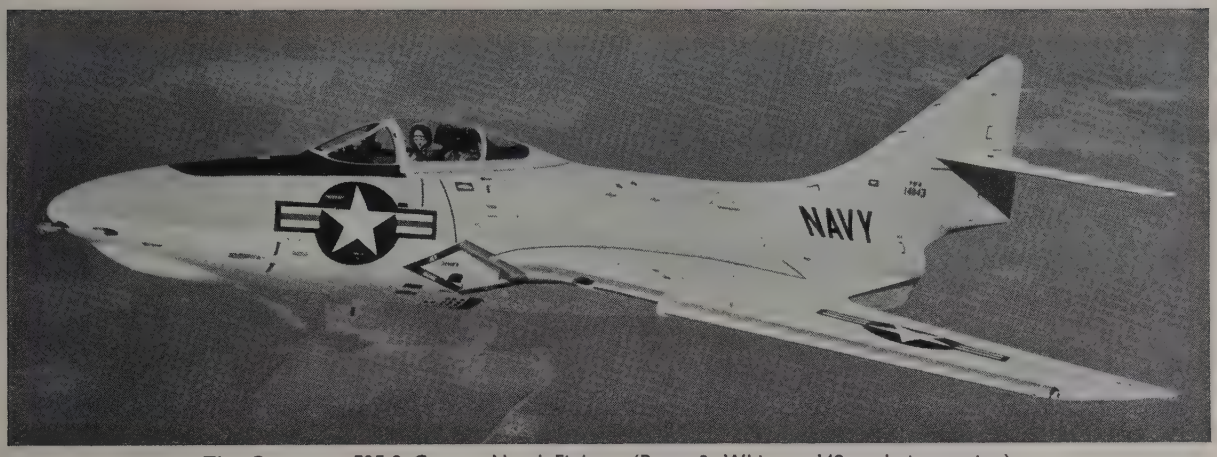
DIMENSIONS.—
Span 31 ft. 7½ in. (9.65 m.).
Length 40 ft. 10 in. (12.44 m.).
Height 12 ft. 9 in. (3.88 m.).

WEIGHTS.—
Normal loaded weight 13,850 lb. (6,290 kg.).

PERFORMANCE.—No data available.



The Grumman F11F-1F Tiger (General Electric J79 turbojet engine with afterburner).



The Grumman F9F-8 Cougar Naval Fighter (Pratt & Whitney J48 turbojet engine).

THE GRUMMAN G-93 COUGAR.
U.S. Navy designation: F9F.

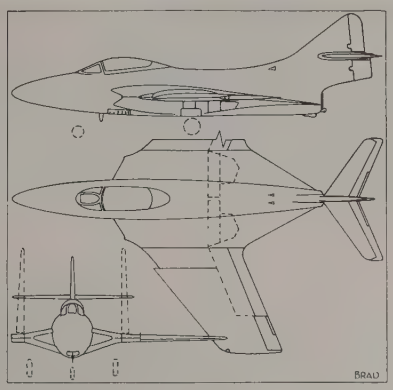
The Cougar is a swept-wing development of the earlier straight-wing G-79 Panther. The fuselage is similar to that of the Panther, but new 35° swept wings and tailplane are incorporated. Spoilers replace the ailerons for lateral control.

Four versions of the Cougar have been, or are being, produced.

F9F-6. One Pratt & Whitney J48-P-8 (7,250 lb.=3,290 kg. s.t.). Prototype first flew on September 20, 1951. Armament consists of four 20 mm. cannon. F9F-6P is an unarmed photographic reconnaissance aircraft with longer nose to accommodate K-17 and trimetrogon cameras.

F9F-7. One Allison J33-A-16A (6,350 lb.=2,880 kg. s.t.). Same as F9F-6 except for power-plant.

F9F-8. One Pratt & Whitney J48-P-8 engine. Development of F9F-6 with greater speed and range. Movable leading-edge slats replaced by fixed cambered leading-edge extensions outboard of fences and trailing-edge extended. Elimination of hydraulic system necessary to operate wing slats provides space for 30 additional U.S. gallons of fuel in each wing. Centre fuselage lengthened by 8 inches to make room for additional 80 U.S. gallons in front, or main, fuselage tank. Total internal fuel load increased by 140 U.S. gallons. First production F9F-8 flew for first time on January 18, 1954. F9F-8P (first flown August 21, 1955) is photographic reconnaissance version with extended nose for cameras. Still in production in 1957.



The Grumman F9F-8 Cougar.

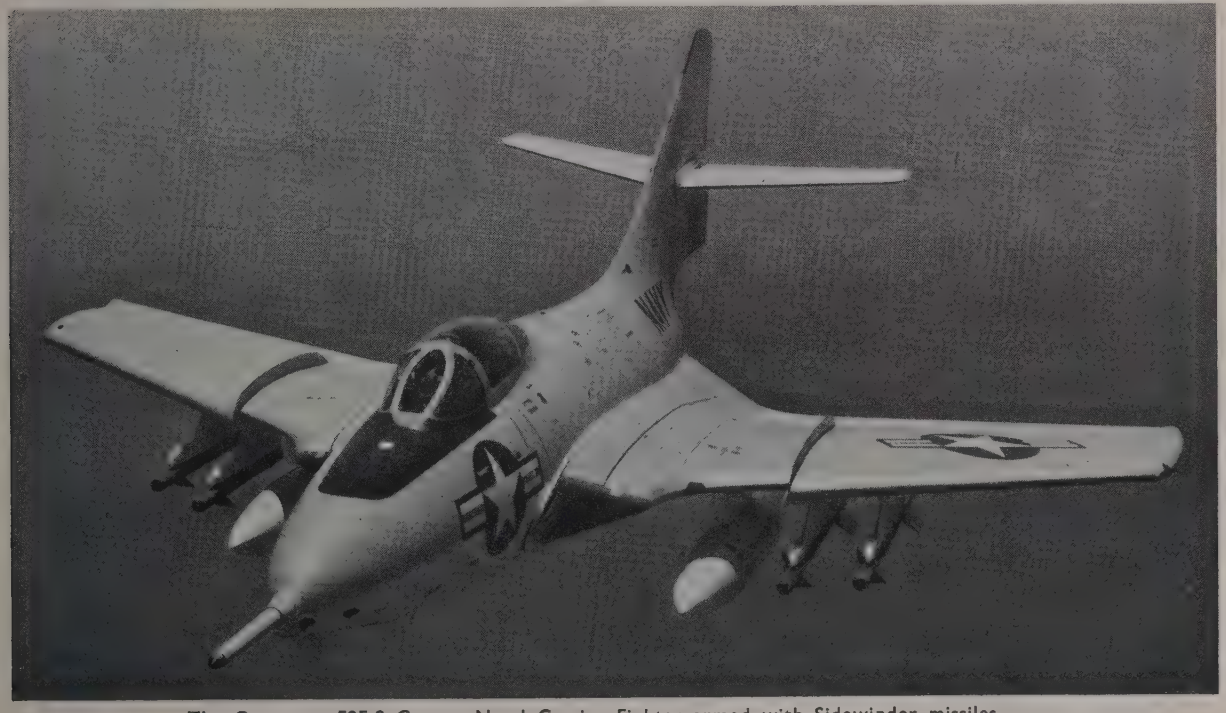
F9F-8T. Two-seat fighter-trainer version of F9F-8, first flown on April 4, 1956. Nose section lengthened 34 in. (86 cm.) to accommodate second cockpit. Both cockpits have Martin-Baker ejector seats and standard F9F-8 controls, instruments, etc. and can be used interchangeably by instructor and pilot. When flown as single-seater forward cockpit is used. Armament consists of two 20 mm. cannon and wide variety of air-to-air or air-to-ground stores can be carried under wings. In addition to training, F9F-8T can be used as an operational fighter. More than 100 ordered for U.S. Navy. First deliveries made in mid-1956.

TYPE.—Single-seat Naval Carrier Fighter.

WINGS.—Low-wing cantilever swept-wing monoplane. Outboard of air inlets wings have 35° L/E. sweepback. All-metal structure with flush-riveted stressed skin. Trailing-edge flap over ¾ span. Lateral control by hydraulically-operated spanwise spoilers on upper surface of wings at 75% of chord line. Artificial feel system incorporated in lateral control. Electrically operated trim-tab near port wing-tip. Auto-slats on F9F-6 and -7, fixed cambered leading-edge extensions on F9F-8.

FUSELAGE.—All-metal structure with flush-riveted stressed skin. Quickly-detachable nose for servicing equipment and interchangeability of armament, photographic and electronic equipment. Tail section detachable for access to engine compartment.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Hydraulically adjustable tailplane linked with flap control to provide constant longitudinal trim during



The Grumman F9F-8 Cougar Naval Carrier Fighter armed with Sidewinder missiles.



The Grumman F9F-8T Cougar Two-seat Fighter Trainer (Pratt & Whitney J48 turbojet engine).

flap movement. Electrically-operated trim-tab in rudder.

LANDING GEAR.—Retractable nose-wheel type. Main wheels raised inwardly into thickened wing roots, nose-wheel backwards into fuselage. Hydraulic actuation. Retractable arrester hook in rear end of fuselage below jet pipe.

POWER PLANT.—One Pratt & Whitney J48 or Allison J33 turbojet engine. Two self-sealing fuel tanks in fuselage and two non-sealing bladder tanks in wings. Increased fuel capacity in fuselage and wings in F9F-8. All tanks pressurised and all fuel can be jettisoned from wing-tip outlets by ram pressure. Provision for two 150 U.S. gallon drop tanks to be carried on underwing bomb shackles.

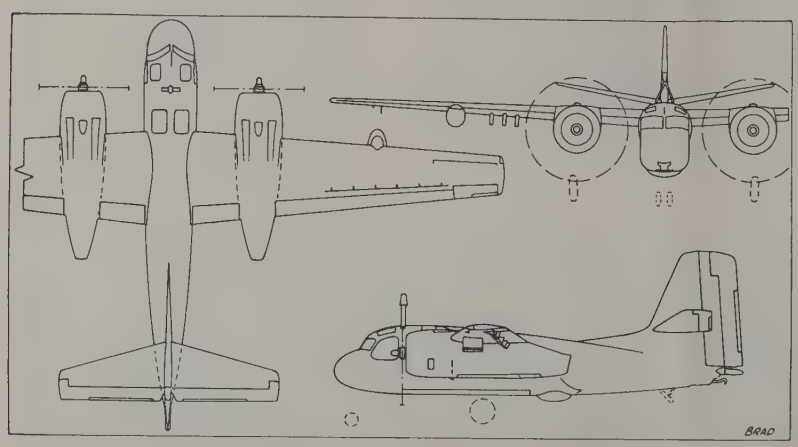
ACCOMMODATION.—Pressurised cockpit forward of wings with sliding and jettisonable canopy. Ejector seat.

ARMAMENT.—Four nose-mounted 20 mm. cannon. Under-wing racks for either four 1,000 lb. bombs or six HVAR rockets or four Philco/Martin Sidewinder air-to-air missiles.

DIMENSIONS.—
Span 34 ft. 6 in. (10.52 m.).
Length (F9F-6 and -7) 40 ft. 2 in. (12.24 m.).
Length (F9F-6P) 41 ft. 2 in. (12.55 m.).
Length (F9F-8) 41 ft. 7 in. (12.68 m.).
Height 12 ft. 3 in. (3.73 m.).

WEIGHTS.—
Normal loaded weight about 20,000 lb. (9,080 kg.).

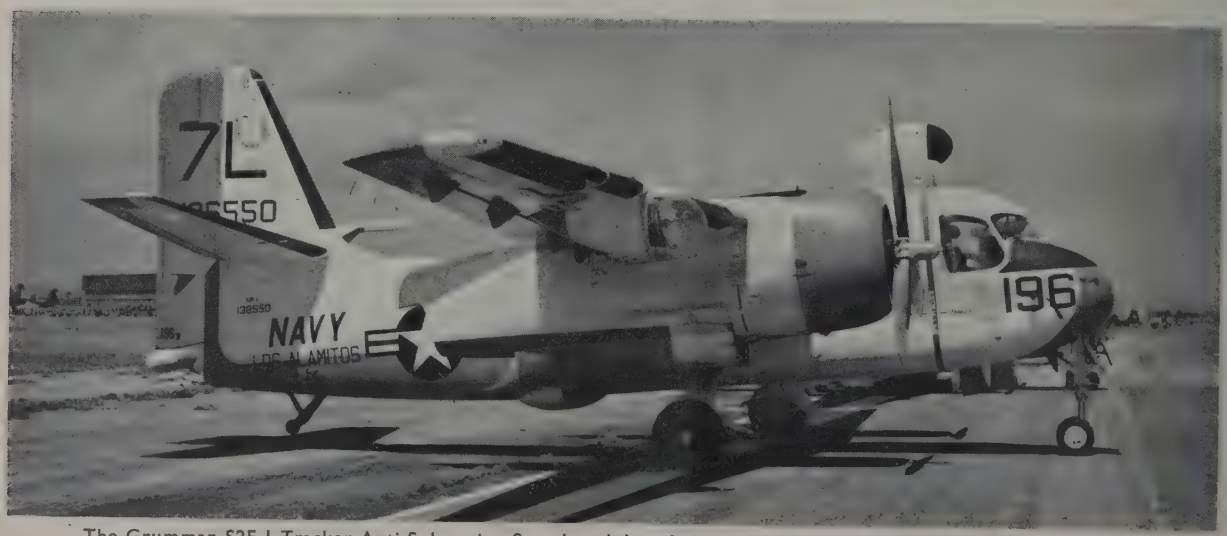
PERFORMANCE (F9F-8).—
Max. speed 712 m.p.h. (1,139 km.h.).
Climb to 40,000 ft. (12,200 m.) 7 min.
Service ceiling 42,000 ft. (12,800 m.).
Range 1,100-1,300 miles (1,770-2,090 km.).



The Grumman S2F-1 Tracker.

THE GRUMMAN G-89 TRACKER
U.S. Navy designation: S2F.

The S2F is a twin-engined carrier-based Anti-Submarine search and attack aircraft which is in production and in service with the U.S. Navy. Six have also been delivered to the Italian Navy and 30 are being delivered to the Japanese Maritime Self-Defence Force. The prototype XS2F-1 made its first flight on December 4, 1952.



The Grumman S2F-1 Tracker Anti-Submarine Search and Attack Aircraft (two 1,525 h.p. Wright R-1820 engines).
(Warren Bodie).



The Grumman S2F-2 Tracker Anti-submarine Aircraft (two 1,525 h.p. Wright R-1820 engines).

The S2F is a high-wing monoplane which is powered by two Wright R-1820 engines. The tricycle landing-gear has a dual-wheel nose-wheel unit and there is a small wheel-bumper aft which is extendable but not fully retractable. A split rudder has been developed for the S2F to assist single-engine performance.

There is a retractable radome under the rear fuselage behind a large bomb-bay, and a retractable MAD gear in the tail. Sonobuoys are carried in special housings in the rear ends of the engine nacelles. Rocket armament under wings.

A crew of four consists of pilot, co-pilot (who serves as navigator, radio-operator and searchlight-operator), radar operator and MAD operator.

The following versions of the S2F have been mentioned :—

S2F-1. Two 1,525 h.p. Wright R-1820-82 engines. First production model.

S2F-2. Developed version of S2F-1 to carry new and larger anti-submarine weapons. An enlarged torpedo bay with asymmetrical extension on port side of fuselage accommodates homing torpedoes.

To compensate for increased weight the tail surfaces have been increased in area.

CS2F-1. Canadian production version of S2F-1 being built under licence for Royal Canadian Navy by de Havilland Aircraft of Canada, Ltd. Powered by two 1,525 h.p. Wright R-1820-82 engines and Hamilton Standard airscrews built by Canadian Pratt & Whitney Aircraft Co., Ltd.

No other details of this aircraft had been released for publication up to the time of going to press.

DIMENSIONS.—
Span 69 ft. 8 in. (21.24 m.).
Length 42 ft. 3 in. (12.88 m.).
Height 16 ft. 3½ in. (4.96 m.).
Span of tail 22 ft. 5 in. (6.84 m.).
WEIGHTS AND PERFORMANCE.—
No data available.

THE GRUMMAN TRADER.
U.S. Navy designation: TF.

The TF-1 Trader is a general utility-transport-trainer version of the S2F Tracker. Its larger fuselage can accommodate up to nine passengers in backward-facing easily-removable seats. To secure cargo in arrested carrier landings a "cage" device, comprising two parallel sets of movable vertical bulkheads secured between upper and lower longitudinal rails, is used. Vertical side posts may be fitted at any point along the length of



The Grumman TF-1 Trader General Utility Aircraft (two 1,525 h.p. Wright R-1820 engines).



The Grumman WF-2 Tracer Early-warning Aircraft (two 1,525 h.p. Wright R-1820 engines).



The Grumman UF-1 Albatross Amphibian (two 1,425 h.p. Wright R-1820 engines).

the "cage" depending on size of load. Secured cargo will withstand maximum force of 20G. Life-rafts are stowed in compartments in the rear ends of the engine nacelles. Except for the fuselage, the main components of the TF-1 are interchangeable with those of the S2F, including power-plant assemblies, outer wings, landing-gear, the larger S2F-2 tail-unit, etc. Equipped with the latest navigational devices the TF-1 is also suitable for all-weather operational carrier-training. The first TF-1 flew for the first time in January, 1955.

THE GRUMMAN TRACER.

U.S. Navy designation: WF-2.

The WF-2 Tracer is a modification of the TF-1 Trader for airborne early warning and fighter direction duties. Suitable for all weather operation, it is equipped with a long-range antenna housed in the largest radome yet designed for a carrier-based aircraft. The aerodynamic prototype flew on March 1, 1957.

Designed, built and flown in less than a year, the WF-2 has a completely new tail assembly with twin fins and rudders to reduce possible wake effects from the radome, which is mounted above the fuselage. Production WF-2's will also have a re-designed wing folding system, in which the wings will fold back to lie alongside the fuselage, instead of upwards as on the TF-1.

A crew of four is carried, with two pilots in the cockpit and two warning system operators in a crew compartment. For airborne early warning operations and training, one pilot moves to the tactical director's position, on a stowable seat located between the operators. This seat is not occupied during take-off and landing.

The aerodynamic prototype houses no detection equipment. Production WF-2 Tracers will be equipped with an early warning system produced by the Hazeltine Electronics Corporation of Little Neck, New York, which has worked with Grumman in the design and development of the system. The skin of the radar housing on the prototype is of aluminium alloy. On the production WF-2 it will be of Fiberglass honeycomb sandwich material.

The WF-2 is suitable for operation from all U.S. Navy attack carriers.

THE GRUMMAN G-64 ALBATROSS.

U.S. Air Force designation : SA-16A.

U.S. Navy and Coast Guard designation: UF-1.

The following versions of the Albatross are in service :—

SA-16A. Basic amphibian design in service with the U.S.A.F. for Sea Rescue duties. 305 built. A few fitted with tri-phibious sprung skis to make possible operation from ice and snow as well as land and water. Will be converted to SA-16B standard as they come in to Grumman for inspection and repair.

SA-16B. Improved version of SA-16A, with higher speed, increased range and improved single-engine performance. Wing span increased by 16 ft. 6 in. (5.03 m.). Larger tail surfaces. Wing slots replaced by cambered leading edges. Antenna housings modified to reduce drag. New high-pressure de-icing boots on wing and tail. Prototype first flown January 16, 1956. Delivery of SA-16A aircraft modified to SA-16B standard began in February, 1957.

UF-1. General utility amphibian for U.S. Navy and Coast Guard, similar to SA-16A. Will be modified to SA-16B standard as received for inspection and repair. Also ordered by Republic of Indonesia, with deliveries to begin in January, 1958.

The following details apply specifically to the SA-16A and UF-1 versions of the Albatross.

TYPE.—Twin-engined General Utility tri-phibian or amphibian flying-boat.

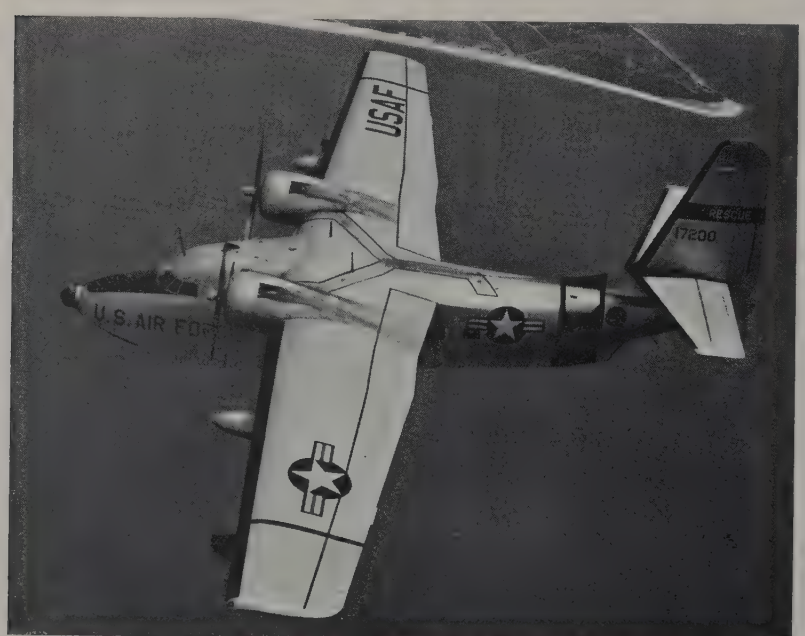
WINGS.—High-wing cantilever monoplane. All-metal structure. Wing in three sections a centre-section permanently attached to hull and two outer sections. Wing area 833 sq. ft. (77.5 m.²).

HULL.—Two-step all-metal hull.

TAIL UNIT.—Cantilever monoplane type. Fin integral with hull. Tailplane span 29 ft. (8.84 m.).

LANDING GEAR.—Retractable nose-wheel type. Main wheels raised into sides of hull, twin nose wheels into nose of hull. Hydraulic retraction. Wheel track 17 ft. 8 in. (5.38 m.). Wheelbase 17 ft. 6 in. (5.34 m.).

POWER PLANT.—Two Wright R-1820-76A nine-cylinder radial air-cooled engines each with a normal rating of 1,275 h.p. from S.L. to 3,000 ft. (915 m.), 975 h.p. at 14,700 ft. (4,480 m.) and with 1,425 h.p. available for take-off. Three-blade Hamilton Standard constant-speed and reversing airscrews. Internal fuel in two tanks in centre-section



The Grumman SA-16B Albatross Amphibian (two 1,425 h.p. Wright R-1820 engines).

outboard of hull with total capacity of 675 U.S. gallons (2,550 litres). Drop tanks of 100, 150 or 300 U.S. gallons (378, 567 or 1,135 litres) each may be carried on bomb-racks under centre-section, one on each side of hull. Each wing-tip float can carry a further 200 U.S. gallons (756 litres).

ACCOMMODATION.—Crew of four/six, pilot, co-pilot, navigator, radio/radar operator and, on special hospital missions, two medical attendants. Cabin may be adapted for various missions. As an ambulance 12 stretchers can be carried and for transport work 10 passengers in addition to crew of four. With seats removed cargo or special equipment can be accommodated. A "dutch-type" door is provided on port side for sea rescue operations or for loading stretchers. Door is split horizontally, the lower half being left in place to give higher freeboard in rough weather. A rescue platform may be attached to bottom door sill from which a crewman secured by safety belt may haul persons aboard from water. Smaller emergency door on starboard side. Both doors may be used for oblique photography and for handling sea anchor. Hatch in roof to facilitate loading of freight. Three life-rafts carried, two in cabin, and one of automatically inflatable type in compartment in top of hull aft of wing. Auxiliary power-plant in compartment aft of main cabin. Lavatory and tail compartment for stowing equipment and gear.

EQUIPMENT.—Racks under each wing can carry bombs, auxiliary fuel tanks, rescue boat or other packaged equipment. Radome on nose of hull. Provision for Jato units to be attached to cabin doors from inside of hull. Stowage for four Jato units below cabin floor between wheel wells. Stowage for two parachute flares in tail compartment. Separate oxygen supplied for crew and passengers with 20 outlets for oxygen masks in cabin.

DIMENSIONS (SA-16A and UF-1).—
Span 80 ft. (24.4 m.).
Length 60 ft. 8 in. (18.5 m.).
Height 24 ft. 3 in. (7.3 m.).

DIMENSIONS (SA-16B).—
Span 96 ft. 6 in. (29.41 m.).
Length 62 ft. 4 in. (19.00 m.).
Height 26 ft. 11 in. (8.21 m.).

WEIGHTS AND LOADINGS (SA-16A and UF-1).—
Weight empty 20,100 lb. (9,125 kg.).
Weight loaded 27,025 lb. (12,270 kg.).
Wing loading 32.4 lb./sq. ft. (158.1 kg./m.^{2}).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

WEIGHTS (SA-16B).—
Weight empty 25,600 lb. (11,612 kg.).
Normal loaded weight 32,100 lb. (14,560 kg.).
Max. loaded weight 35,600 lb. (16,148 kg.).

PERFORMANCE (SA-16A and UF-1).—
Max. speed at S.L. 247 m.p.h. (395 km.h.).
Max. speed at 18,800 ft. (5,735 m.) 264.5 m.p.h. (423 km.h.).
Cruising speed 225 m.p.h. (360 km.h.).
Stalling speed 79 m.p.h. (126.4 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Take-off distance at S.L. (no wind) 900 ft. (275 m.).
Take-off distance against 25 m.p.h. (40 km.h.) wind (off land) 330 ft. (100 m.).
Range (with 600 U.S. gallons = 2,270 litres external fuel) 2,700 miles (4,320 km.).
Endurance (with 600 U.S. gallons = 2,270 litres external fuel) 22.9 hours.

GYRODYNE

GYRODYNE COMPANY OF AMERICA, INC.

HEAD OFFICE AND WORKS: FLOWERFIELD, ST. JAMES, LONG ISLAND, NEW YORK.

Chairman: John A. Roosevelt.

President and Treasurer: Peter J. Papadakos.

Vice-Presidents: D. W. MacVicar and Rear Admiral James D. Barner (U.S.N. Ret.).

Comptroller: Joseph J. Dorn.

Secretary: Nicholas Xanthaky.

The Gyrodyne Company of America, Inc. (originally organised under the name P.C. Helicopter Corpn). was incorporated in New York State on August 7, 1946. The company was formed for the purpose of developing advanced types of rotary-wing aircraft.

The Gyrodyne Model 2C co-axial helicopter has successfully completed a comprehensive flight test programme under contract to the Departments of Defense. These tests served to demonstrate the performance, stability, and control characteristics of the Gyrodyne co-axial rotor system.

The Company is currently engaged on a contract from the U.S. Navy Bureau of Aeronautics to design, build and test a prototype of the XRON-1 one-man portable co-axial "rotorcycle" for the U.S. Marine Corps.

Commercial plans include the development of helicopters utilising the Gyrodyne co-axial rotor system.

The Gyrodyne company is also actively engaged in sub-contract work for certain major aircraft companies.

THE GYRODYNE ROTORCYCLE.

U.S. Navy designation: XRON-1.

The XRON-1, which is under development for the U.S. Navy Bureau of Aeronautics, is a one-man portable helicopter intended for use by the U.S. Marine Corps for "observation, liaison and small unit tactical manoeuvres."

Its concept stems from a design competition held by the U.S. Navy in late 1953, to find an aircraft which could be collapsed into a small package for easy transportation and could be quickly assembled in the field. Prime objectives of the design are extreme simplicity and adaptability to large-scale low-cost production, using any one of a variety of different engines in the 40-75 h.p. range to power production aircraft.

The prototype XRON-1 was designed, built and flown in less than one year from date of contract. It first flew in November, 1955, powered by a 40 h.p. Nelson engine, and this model is described below. Subsequently, the XRON-1 has been flown with a specially-modified version of the German Porsche Super engine of 1,600 cc. and rotors of 17 ft. (5.18 m.) diameter. As a result of the success of this installation, Porsche are developing for the XRON-1 a helicopter version of their Type 678 light aircraft engine. This will give the XRON-1 a cruising speed of about 62 m.p.h. (100 km.h.) and service ceiling of about 13,000 ft. (4,000 m.).

Plans are under way to certificate the Rotorcycle for commercial use, but because of military commitments it is not expected that a commercial model will be available for at least two years.

TYPE.—Single-seat Portable Helicopter.

ROTOR SYSTEM.—Two two-blade co-axial contra-rotating rotors. Blades of semi-rigid type and of laminated wood construction, two moulded halves being bonded together to form blade. Blade aerofoil NACA 00 Series.

ROTOR DRIVE.—By universal shaft from engine to transmission unit at top of rotor mast. Transmission unit includes clutch, rotor brake, free-wheeling unit and main transmission drive. Drive is composed of five spiral bevel gears in two stages. Second stage has pinion between two opposing ring gears which set up counter-rotation. Clutch in two parts, a friction clutch to bring rotors up to engine speed and a positive jaw clutch which is engaged after rotor and engine speeds are synchronised. Entire rotor mast is pressure-lubricated to eliminate need for separate transmission oil-cooler.

FUSELAGE.—Consists of a box beam of riveted metal construction to which are attached the pilot's seat, power-unit, rotor mast and landing-gear. A tubular tail truss carries the inverted-Vee tail. Magnesium castings and tubes are used extensively throughout the structure.

TAIL UNIT.—Inverted-Vee tail surfaces are fixed and provide stability in forward flight.

LANDING GEAR.—Three-wheel unit. Main wheels are mounted on an aluminium cross axle. Small fixed nose-wheel.

POWER PLANT.—One 40 h.p. Nelson H-59 four-cylinder opposed two-stroke fan-cooled engine mounted on box beam aft of pilot. Drive shaft to transmission unit has universal joint at each end to accommodate mis-alignments arising from torsional movement of engine on its mounting. Manual starting. Gravity feed from fuel tank on tail truss above engine.

ACCOMMODATION.—Pilot's seat on forward end of box beam. Provision for parachute.

CONTROLS.—Cyclic-pitch control by hanging column. collective-pitch lever, with twist-grip throttle control in conventional position at pilot's left hand. Directional control by rotor-tip brake system operated by rudder bar.

DIMENSIONS.—
Rotor diameter 15 ft. (4.75 m.).
Fuselage length 10 ft. 5 in. (3.17 m.).
Overall height 8 ft. (2.44 m.).
Overall width 3 ft. 10½ in. (1.19 m.).

WEIGHT.—
Weight loaded less than 500 lb. (227 kg.).

PERFORMANCE.—
Restricted.



The Gyrodyne XRON-1 Rotorcycle (40 h.p. Nelson H-59 engine).

HAYDEN

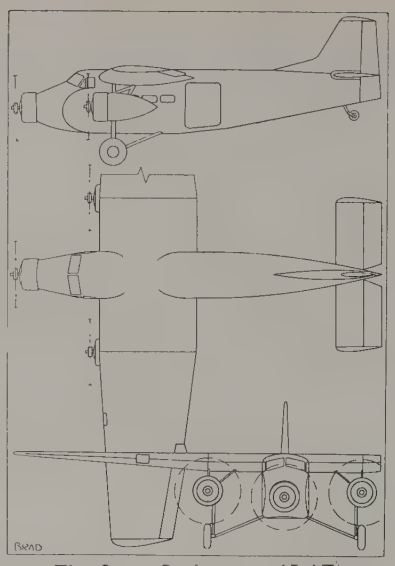
HAYDEN AIRCRAFT CORPORATION.

HEAD OFFICE: 10451, E. CENTER STREET, BELLFLOWER, CALIFORNIA.

President and Chairman: Robert E. Hayden.

The Hayden Aircraft Corporation was incorporated on January 15, 1955, to build the Bushmaster 15-AT. This aircraft has been designed by the application of modern engineering techniques to the basic airframe of the Ford Trimotor, which was designed in its original form by the late William B. Stout in 1926. The first Bushmaster was scheduled for completion late in 1957 and the details given below apply to this aircraft. Production Bushmasters will differ in a few minor details.

At the time of the company's incorporation, Mr. Stout was a member of its advisory board, the other members being Cdr. George O. Noville and Mr. Gene May, former chief test pilot of the Douglas Aircraft Company.



The Stout Bushmaster 15-AT.

THE STOUT BUSHMASTER 15-AT.

TYPE.—Three-engined Passenger and Freight Transport.

WINGS.—High-wing cantilever monoplane. Aerofoil section Ford No. 2. Aspect ratio 7.3. Chord 12 ft. 10 in. (3.91 m.) at root, 7 ft. 8 in. (2.33 m.) at tip. Incidence —3° at root, 0° at tip. All-metal structure with three main and five auxiliary aluminium spars. No ribs. Corrugated aluminium skin formed to aerofoil. All-metal ailerons with corrugated aluminium skin on aluminium formers. No flaps on prototype, but flaps will be fitted to production aircraft. Total area of ailerons 52 sq. ft. (4.83 m.²). Gross wing area 843 sq. ft. (78.32 m.²).

FUSELAGE.—Rectangular section all-metal structure. Corrugated aluminium skin on box frame of rolled U-section members. (Substantially the same as Ford 5-AT, but 18 in. = 0.46 m. wider in cargo section).

TAIL UNIT.—Cantilever monoplane type. All-metal construction, with corrugated aluminium skin over formers. Areas: fin 15.7 sq. ft. (1.46 m.²), rudder 24.2 sq. ft. (2.24 m.²), elevators 72.4 sq. ft. (6.73 m.²), tailplane 46.8 sq. ft. (4.35 m.²). Tailplane span 21 ft. 2 in. (6.45 m.).

LANDING GEAR.—Fixed tail-wheel type. Oleo shock-absorbers. Goodyear 11.00-12 aluminium disc wheels. Goodyear single disc brakes. Wheel track 20 ft. (6.10 m.). Wheelbase 35 ft. 6 in. (10.82 m.). Float or ski landing gear optional.

POWER PLANT.—Three 450 h.p. Pratt & Whitney R-985 Wasp Junior nine-cylinder radial air-cooled engines, reconditioned in approved shops to factory standards. Hamilton Standard two-blade constant-speed airscrews with Type 2D-30 hub and Type 6101A-14 or -16 blades. All fuel in three wing tanks, each of 100 U.S. gallons (378 litres) capacity. Total oil capacity 30 U.S. gallons (114 litres).

ACCOMMODATION.—Crew of two with dual controls. Nineteen folding seats in passenger version as optional equipment. Basic aircraft is cargo transport with reinforced floor. Cabin dimensions 20 ft. long × 6 ft. wide × an average 6 ft. high (6.10 m. × 1.83 m. × 1.83 m.). Volume 720 cub. ft. (20.39 m.³). Cargo loading door on port side size 5 ft. × 5 ft. 10 in. (1.52 m. × 1.78 m.).

DIMENSIONS.—
Span 79 ft. 4 in. (24.18 m.).
Length 50 ft. 4 in. (15.34 m.).
Height 15 ft. 1 in. (4.60 m.).

WEIGHTS.—
Weight empty 6,800 lb. (3,085 kg.).
Weight loaded 12,500 lb. (5,670 kg.).

PERFORMANCE.—
Max. speed 145 m.p.h. (234 km.h.).
Cruising speed 125 m.p.h. (201 km.h.).
Stalling speed (flaps down) 45 m.p.h. (72 km.h.).
Range 600 miles (965 km.).
Take-off distance (with flaps), empty 100 ft. (30 m.).
Take-off distance (with flaps), full load 600 ft. (183 m.).

HELIO

HELIO AIRCRAFT CORPORATION.

HEAD OFFICE: BOSTON METROPOLITAN AIRPORT, NORWOOD, MASS.

President and Chairman of the Board: Dr. L. L. Bollinger.

Vice-President: Dr. O. C. Koppen.

Manager and Chief Engineer: Lawrence N. Smithline.

The original Helio Aircraft Company was formed by Dr. Otto C. Koppen of the Massachussetts Institute of Technology, and Dr. Lynn Bollinger, of the Harvard Graduate School of Business Administration, to develop a light aircraft of greater potential utility than any existing type. Quick take-off and climb, high cruising speed, fully-controllable flight at low speeds, freedom from stall and spin, low landing speed, low noise level, etc., were some of the qualities aimed at.

The original prototype consisted of an extensively rebuilt Piper Vagabond light aircraft. It first flew on April 8, 1949, and has been described fully in earlier editions of this annual.

After considerable flight testing of this prototype, the Helio Aircraft Corporation designed a new four-seat aircraft known as the Helioplane-Four. At first, it incorporated most of the novel design features of the prototype; but was later redesigned and re-engined with a readily-available standard power unit and airscrew.

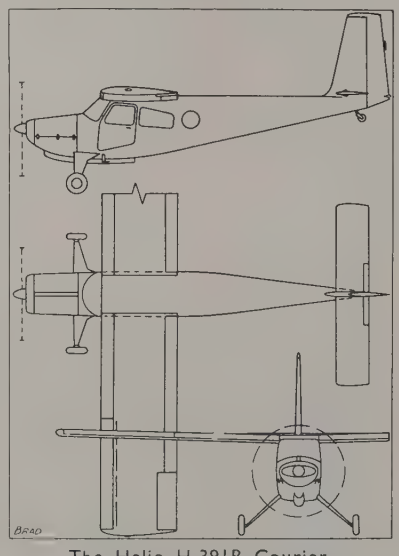
Now known as the Helio Courier, this aircraft first flew in its new form in 1953, and was followed by the first production aircraft in 1954. It is an all-metal cantilever high-wing monoplane, but retains the full-span automatic leading-edge slots and high-lift flap system of the earlier model. The original scheme of interconnecting the ailerons and the lower part of the rudder has been abandoned.

The Courier has been awarded C.A.A. Type Certificate 1A8 and is being built by Mid-States Manufacturing Corporation, of Pittsburg, Kansas. This company was acquired by Helio Aircraft Corporation in July, 1956.

Fleet Manufacturing, Ltd. of Fort Erie, Ontario, Canada, is licenced to build the Courier in Canada and holds the sales rights for Canada and the British Commonwealth.

The Helio Aircraft Corporation retains all proprietary rights and is continuing engineering and design development at its plant in Norwood, Mass.

During 1956, a floatplane version of the Courier was produced, followed early in 1957 by the Helio H-392 Strato-Courier with more powerful supercharged engine.



The Helio H-391B Courier.

THE HELIO H-391B COURIER.

By August 1956, a total of 38 Couriers had been built, of which 30 were being used for executive and personal flying. A floatplane version is also available, with similar short take-off and landing characteristics and a cruising speed of 139 m.p.h. (223 km.h.).

TYPE.—Four-seat Light Monoplane.

WINGS.—High-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 6.58. Chord 6 ft. (1.83 m.). Dihedral 1°. Incidence 3°. All-metal single-spar structure. Full-span automatic leading-edge slats. NACA high-lift slotted all-metal flaps over 74% of span. Frise-type ailerons have duralumin frames and fabric covering. Total area of ailerons 20.7 sq. ft. (1.92 m.²). Total area of flaps 38.1 sq. ft. (3.54 m.²). Gross wing area 231 sq. ft. (21.46 m.²).

FUSELAGE.—All-metal structure. Cabin section has steel-tube framework, rear section is an aluminium monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. There is no fixed tailplane. Areas: fin 15.20 sq. ft. (1.41 m.²), rudder 16.60 sq. ft. (0.99 m.²), one-



The Helio Courier (260 h.p. Lycoming engine).

piece "flying tail" 37.5 sq. ft. (3.48 m.²). Span of tail 13 ft. 4 in. (4.06 m.).

LANDING GEAR.—Fixed tail-wheel type. Cantilever struts with oleo-pneumatic springing. Goodyear cross-wind landing-gear optional. Goodyear wheels and hydraulic brakes. Track 9 ft. (2.74 m.). Wheelbase 23 ft. 5 in. (7.14 m.). Alternative floatplane landing gear.

POWER PLANT—One 260 h.p. Lycoming GO-435-C2B six-cylinder horizontally-opposed air-cooled geared engine. Ejector tube engine cooling. Hartzell 101 two-blade constant-speed airscrew. Two 30 U.S. gallon (113 litre) wing tanks. Oil capacity 2½ U.S. gallons (9.45 litres).

ACCOMMODATION.—Cabin seats four in two pairs. Dual controls for front seats. CAA standard instrument panel. Aerodynamically positive (fully non-stallable) control system. Special over-strength cabin and seat structure based on Flight Safety Foundation recommendations. Two large doors at left front and right rear. Large baggage compartment (200 lb. = 91 kg. capacity) behind rear seats. If rear seats are removed a 6 ft. (1.83 m.) long cargo compartment is available for 1,000 lb. (454 kg.) industrial loads.

DIMENSIONS (Landplane).—
Span 39 ft. (11.89 m.).
Length 30 ft. (9.15 m.).
Height 8 ft. 10 in. (2.69 m.).

WEIGHTS AND LOADINGS (Landplane).—
Weight empty 1,880 lb. (853 kg.).
Weight loaded (normal category) 3,000 lb. (1,362 kg.).
Wing loading 13 lb./sq. ft. (63.5 kg./m.²).
Power loading 11.5 lb./h.p. (5.22 kg./h.p.).

PERFORMANCE (Landplane).—
Cruising speed 162 m.p.h. (261 km.h.) at 8,500 ft. (2,590 m.).
Min. speed (power on) under 30 m.p.h. (49.6 km.h.).
Initial rate of climb 1,300 ft./min. (400 m./min.).
Service ceiling 23,100 ft. (7,040 m.).
Range 700 miles (1,127 km.).
Take-off distance to 50 ft. (15.25 m.) 500 ft. (152 m.).
Landing distance from 50 ft. (15.25 m.) 500 ft. (152 m.).

THE HELIO H-392 STRATO-COURIER.

Basically similar to the H-391B Courier, the H-392 differs mainly in having a 340 h.p. Lycoming GSO-480-A1A6 supercharged six-cylinder horizontally-opposed air-cooled engine, driving a three-blade Hartzell Automatic constant-speed airscrew.

Intended mainly for high-altitude photographic work, the Strato-Courier operates as an industrial aircraft under CAR 8 requirements at over 30,000 ft. (9,145 m.) with full payload. Its high wing and absence of struts also make it suitable for low-altitude oblique photography.

WEIGHTS.—
Weight empty 1,780 lb. (807 kg.).
Weight loaded 3,200 lb. (1,452 kg.).

PERFORMANCE.—
Max. speed 194 m.p.h. (312 km.h.).
Cruising speed 182 m.p.h. (293 km.h.).
Min. flying speed 30 m.p.h. (49.6 km.h.).
Rate of climb at S/L over 2,000 ft./min. (610 m./min.).
Climb to 30,200 ft. (9,200 m.) 50 min.
Take-off distance to 50 ft. (15.25 m.) in still air, 300 ft. (91 m.).
Landing distance in still air 225 ft. (69 m.).
Max. still air range over 1,000 miles (1,610 km.).

HILLER

HILLER HELICOPTERS.

HEAD OFFICE: 1,350, WILLOW ROAD, PALO ALTO, CALIFORNIA.

WASHINGTON OFFICE: 1,632 K STREET, N.W., WASHINGTON, D.C.

President: Stanley Hiller, Jr.

Executive Vice-President and General Manager: E. T. Bolton.

Vice-Presidents: A. J. M. Chadwick and A. W. B. Vincent.

Director of Advanced Research: Frank A. Heileman.

Chief Engineer: Robert A. Wagner.

Secretary and Treasurer: James Dresher.

During 1957, Hiller Helicopters continued as its main production activity the building of H-23 military helicopters for the U.S. Army, together with the commercial version of this aircraft, known as the Hiller UH-12.

Development and military evaluation of the Hornet ram-jet helicopter was continued and the "Flying Platform" ducted fan research vehicle underwent modification and additional flight testing to explore further its new principles of flight and control. As a result of this work, the U.S. Army awarded Hiller a contract for two prototypes of a developed version in November, 1956.

Also under development is the XROE-1 portable one-man helicopter, for which Hiller was awarded a contract by the U.S. Navy Bureau of Aeronautics in 1954.

Other projects and studies made under contract to the U.S. government have included the design and construction of a retractable rotor system for fixed wing aircraft, studies for large "flying crane" aircraft utilising a series of ducted fans for vertical lift, and a study on optimum military short-haul transport systems for the U.S. Office of Naval Research.

This last study included investigation of the possibilities of a turboprop-powered tilting-wing convertiplane and Hiller has now received a contract for the development of such an aircraft, designated the X-18, for the U.S. Air Force.

About 200 of the company's 900 employees are engaged on research and development. All projects of an advanced nature are now undertaken by the Advanced Research Division, which was formed in 1955 with its own offices, laboratories and workshops.

THE HILLER X-18.

In February, 1957 it was announced that the U.S. Air Force had awarded Hiller an initial contract for the development of a twin-engined tilting-wing convertiplane to be designated X-18. An artist's impression shows that this aircraft has been designed around the fuselage of a Chase YC-122 transport, with new wing and Allison YT40-A-14 turboprop engines. First flight was scheduled for late 1957 or early 1958.

The high-set wing is designed to pivot through 90 degrees for take-off, so that the airscrews work in a similar way to the rotors of a helicopter. Control in pitch and yaw during this phase is to be achieved by the use of small turbojet engines mounted under the tailplane. During cruising flight, the X-18 will look and work like a conventional twin-engined transport aeroplane, but with much less wing area than is usual.



The Hiller XROE-1 Portable Rotorcycle (43 h.p. Nelson engine).

THE HILLER XROE-1.

Hiller was successful in winning one of two contracts awarded by the U.S. Navy Bureau of Aeronautics in 1954 for the development and production of a prototype one-man portable "rotorcycle" for the U.S. Marine Corps.

The first flight of this aircraft, which is designated XROE-1, was announced by the U.S. Navy on January 10, 1957.

The XROE-1 is designed to be collapsed into a small package for easy transportation or parachute drop, and can be quickly dismantled and re-assembled. It weighs less than 250 lb. (113 kg.) and is powered by a 43 h.p. Nelson four-cylinder horizontally-opposed two-stroke air-cooled piston-engine.

A two-bladed main rotor, 18 ft. (5.49 m.) in diameter, with the usual Hiller "Rotor-matic" cyclic-pitch control system, is mounted above the pilot's head, and there is a small two-bladed anti-torque rotor at the end of the tubular tail-boom. The entire aircraft is held together by quick-release "pins" and can be assembled by one person in less than ten minutes.

Although not literally a strap-on rotorcycle, the XROE-1 comes close to this concept, because the pilot sits on a small tractor-type seat with the engine just behind his back. Its uses include observation, liaison and small unit tactical manoeuvres.

THE HILLER MODEL HJ-1 HORNET.

U.S. Army designation: YH-32.
U.S. Naval designation: HOE-1.

The Hornet is a small ramjet-powered helicopter, of which 12 have been procured by the U.S. Army and 3 by the U.S. Navy for evaluation. In its original form in 1950, it was flown with a canted rudder instead of a tail rotor to compensate for torque; but was later redesigned entirely to meet military requirements.

A new re-design is now in hand under military contract, to further reduce the weight and cost of the aircraft.

The Hiller 8RJ2B ramjet engine which powers the Hornet was, in October, 1954, awarded an Approved Type Certificate by the C.A.A. The engine thus became the first ramjet power-unit to be certificated in the United States and also the first CAA-approved tip-mounted power-plant for helicopters. Details of this power-unit will be found in the Engine Section of this book.

TYPE.—Two-seat Ramjet-driven Helicopter.

ROTOR SYSTEM.—Two-blade all-metal rotor. Solid extruded aluminium leading-edge and

built-up magnesium trailing-edge. Hiller "Rotor-Matic" cyclic-pitch control system as used in the Model UH-12. Rotor blade area 18.2 sq. ft. (1.69 m.²). Rotor diameter 23 ft. (7 m.).

FUSELAGE.—Combination Fiberglass and steel-tube structure. A cabin enclosure having a Fiberglass and plastic laminate skin and Plexiglass windscreen can be installed and detached in a few minutes.

TAIL UNIT.—Small 2 ft. 8 in. (0.70 m.) diameter single-blade tail rotor used to provide directional control only.

LANDING GEAR.—Simple twin skid gear.

POWER PLANT.—Two Hiller 8RJ2B ramjet units attached to extremities of rotor blades by two shear-type bolts each. All electric and fuel connections of plug-in type. Each unit, which has no moving parts, develops 40 lb. (18 kg.) s.t. at 550 rotor r.p.m. and weighs 12.7 lb. (5.76 kg.). Fuel is pressure fed to ramjets by separate pipes from tank in fuselage. Rotor must be spun up to 50 r.p.m. by auxiliary means before ramjets can be started. This done by small 1 h.p. gasoline engine which is started by rip-cord, but can be achieved by hand-cranking or small electric motor. Starting procedure is then as follows :—fuel flow valves are opened and starter button is depressed. This button activates a magneto which energises electrodes in the ramjet units, which then fire. When 550 r.p.m. is reached the helicopter may be taken off. Fuel capacity 52 U.S. gallons (196.5 litres).

ACCOMMODATION.—Open or enclosed accommodation for two side-by-side on cross-bench seat. Baggage compartment behind seat in cabin enclosure.

CONTROLS.—Hiller "Rotor-Matic" paddle control system with cyclic-pitch control column branched at upper end to make it accessible to both occupants. Collective-pitch levers, which also incorporate the fuel flow valve are located conveniently between the two occupants. Foot pedals are provided for directional control.

DIMENSIONS.—
Rotor diameter 23 ft. (7.0 m.).
Fuselage width 3 ft. 9 in. (1.14 m.).
Overall height 7 ft. 10 in. (2.38 m.).

WEIGHTS.—
Empty 544 lb. (246 kg.).
Max. useful payload 536 lb. (243 kg.).
Loaded 1,080 lb. (489 kg.).

PERFORMANCE.—
Cruising speed 69 m.p.h. (111 km.h.).
Initial rate of climb 700 ft./min. (215 m./min.).
Service ceiling 6,900 ft. (2,100 m.).
Normal still air range 28 miles (45 km.).
Endurance 25 min.



The Hiller HOE-1 Hornet Ramjet-driven Helicopter. (*Gordon Williams*).



The Hiller H-23D Raven Utility Helicopter (250 h.p. Lycoming O-435 engine).

THE HILLER MODEL UH-12.
U.S. Army designation: H-23 Raven.
U.S. Navy designation: HTE.

The H-23C and H-23D, now in production for the U.S. Army, are the latest models of the H-23 series of training and utility helicopters designed specifically for military use. A total of more than 900 have been delivered, and commercial versions, designated the Hiller Model 12-C and UH-12D, are also in production.

Civil and military versions of the H-23 are as follows :—

H-23B. Air evacuation helicopter for the U.S. Army with 200 h.p. Franklin Model 6V4-200-C33 engine. Stretcher installation consists of two folding stretchers in heated carriers, one on each side of cabin. May also be used for training. Wide track skid landing-gear. Thirty-five H-23B's supplied to Holland in 1955.

H-23C. Current production version for U.S. Army with same engine as H-23B. New full bubble-type canopy, re-designed rotor hub and cyclic control scissors, size of instrument panel reduced by one-third, improved engine and tail rotor system. First H-23C delivered on December 6, 1955.

H-23D. Fitted with 250 h.p. Lycoming engine, new transmission system designed for 1,000 hours' service between overhauls and capable of absorbing up to 280 h.p. and a new tail rotor assembly. First prototype flew on April 3, 1956, and deliveries were scheduled for the latter part of 1957, extending well into 1959.

HTE-2. Two-seat training version of H-23B for U.S. Navy. Four-wheel landing-gear. Twenty HTE-2's supplied to the Royal Navy.

Model 12-B. Commercial version of H-23B. Granted Approved Type Certificate No. 6H2 by the C.A.A. in November, 1951.

Model 12-C. Commercial version of H-23C. In production.

Model UH-12D. Commercial version of the H-23D.

The following details apply specifically to the H-23D, but are generally applicable to other versions :—

TYPE.—Three-seat Utility Helicopter.

ROTOR SYSTEM.—Two-blade main rotor universally mounted on power shaft with small servo rotor, the latter connected directly through universally-mounted transfer bearing and simple linkage with pilot's cyclic control stick. Movement of control stick introduces to the servo rotor paddles positive or negative pitch changes, and aerodynamic forces thus developed tilt the rotor head and produce the effect of cyclic pitch changes to the rotor blades. H-23C and D have expanded main rotor and control rotor tilt stops (9°-12° rotor hub). Two-blade anti-torque rotor at rear end of fuselage driven off engine through universal joint and shafting. Main rotor/engine r.p.m. ratio 1 : 8.64. Anti-torque rotor/engine r.p.m. ratio 1 : 1.45. The main rotor blades are initially of solid wood laminations with a steel spar along the leading-edge for balance purposes. Covering is of Fiberglass with a stainless-steel leading-edge. An all-metal rotor is also being developed. All-metal tail rotor blades.

FUSELAGE.—Fabricated sheet metal fully-stressed semi-monocoque platform structure supports the non-stressed cabin enclosure, seats and controls, engine mounting and landing-gear. Four-section canopy for ease of shipment and replacement. Tail boom of beaded sheet metal with no internal stiffeners.

LANDING GEAR.—Wide-tread skid. Two



The Hiller HTE-2 Naval Training Helicopter.

small wheels can be fitted at rear to facilitate ground handling. Skid track 7 ft. 6 in. (2.28 m.). Alternative float landing-gear available.

Power Plant.—One 250 h.p. Lycoming O-435-23A six-cylinder horizontally-opposed fan-cooled engine mounted with main shaft vertical on steel-tube quadrapod attached to fuselage platform by four bolts. Supercharger optional. Rotor transmission through two-stage planetary gear assembly. Normal fuel capacity 48 U.S. gallons (181 litres). Can be fitted with 18 U.S. gallon (64 litres) auxiliary tank. Oil capacity 3.3 U.S. gallons (12.5 litres.).

Accommodation. — Enclosed bubble-type cabin seating three. Floor type cyclic pitch control columns with collective pitch levers on left side of seats. Electric trim switch on both centre and left-hand cyclic columns, and throttle friction adjustment on collective pitch levers. Large map storage pocket behind starboard passenger seat. The H-23D casualty evacuation version carries two folding type litters, one either side of cabin. Litter carriers are heated. The civil Model UH-12D can be easily adapted for agricultural operations, using dust, spray or aerosol equipment. Other optional equipment includes air-to-ground broadcast loud-speaker and external net and load sling for freight transport.

Dimensions.—
Main rotor diameter 35 ft. (10.67 m.).
Fuselage length 27 ft. (8.23 m.).
Height to top of rotor head 10 ft. 1 in. (3.07 m.).
Diameter of tail rotor 5 ft. 6 in. (1.67 m.).

Weights and Loadings (Model 12-B and H-23B).—
Weight empty (12-B) 1,656 lb. (752 kg.).
Weight empty (H-23B) 1,737 lb. (788.5 kg.).
Weight loaded 2,500 lb. (1,135 kg.).
Disc loading 2.6 lb./sq. ft. (12.68 kg./m.²).
Power loading 12.5 lb./h.p. (5.67 kg./h.p.).

Weights and Loadings (Model 12-C and H-23C).—
As 12-B and H-23B except:—
Weight empty (12-C) 1,642 lb. (745 kg.).

Weights and Loadings (Model UH-12D and H-23D).—
Weight empty (UH-12D) 1,720 lb. (780 kg.).
Weight empty (H-23D) 1,787 lb. (810 kg.).
Weight loaded 2,600 lb. (1,179 kg.).
Disc loading 2.7 lb./sq. ft. (13.18 kg./m.²).
Power loading 10.4 lb./h.p. (4.72 kg./h.p.).

Performance (Model 12-C and H-23C).—
Max. speed 84 m.p.h. (134.4 km.h.).
Cruising speed 76 m.p.h. (122 km.h.).
Max. rate of climb 770 ft./min. (235 m./min.).
Hovering ceiling in ground effect 2,600 ft. (795 m.).
Absolute ceiling 11,500 ft. (3,505 m.).
Service ceiling 10,100 ft. (3,080 m.).
Range at 71 m.p.h. (114 km.h.) 138 miles (222 km.).
Range at 71 m.p.h. (114 km.h.) with 18 U.S. gallon (64 litre) auxiliary tank 224 miles (360 km.).

Performance (Model UH-12D and H-23D).—
Max. speed 94 m.p.h. (151 km.h.).
Cruising speed 83 m.p.h. (134 km.h.).
Rate of climb at S/L. 1,000 ft./min. (305 m./min.).
Hovering ceiling outside ground effect 3,500 ft. (1,065 m.).
Ceiling 13,600 ft. (4,145 m.).
Max. range 274 miles (441 km.).



On the left two views of the Hiller Flying Platform in free flight and, on the right, a model of the three-engined version which is under development.

THE HILLER "FLYING PLATFORM."

U.S. Army name: Pawnee.

The "Flying Platform" is a research vehicle which has been designed and built for the Office of Naval Research mainly to test the principle of stabilised control with the ducted fan type of lift and propulsion system. The co-axial contra-rotating fans are enclosed in a ring, the upper lip of which is flared outward. The induced flow of air through the ring, which is approximately 6 ft. (1.83 m.) in diameter, reduces air pressure over the lip, thus making the pressure under the lip relatively greater and giving the same effect as unshrouded airscrews of 40% greater diameter. The fans are driven through V-belts by two Nelson H-56 air-cooled engines.

The basic structure consists of a centre support and four beams of streamlined section which form a cruciform support for the duct and landing gear. The engines are mounted on the centre fitting and beams, one forward and one behind the pilot. Landing loads are taken by two bungee rings on each landing gear strut.

The duct is made in two pieces, the propeller shroud and inlet duct, and is non-structural. For rigidity, the shroud is of sandwich construction, consisting of 0.012 in. (0.30 mm.) aluminium skins with a foamed-in-place plastic filler. The inlet duct is made of plastic-impregnated Fiberglass.

Fuel is carried in a tank atop the forward engine. The only pilot's control is a twist-grip throttle on the port side of the safety rail, and this controls climb and descent. The pilot shifts his weight or leans in the direction in which he wishes to go, for directional movement.

Hiller received a contract from the U.S. Office of Naval Research for the development of the free flight platform in late 1953. The prototype was completed in September, 1954, and initial tethered tests began on January 21, 1955. The first free flight was made on February 4, 1955.

As a result of subsequent successful flight trials, the U.S. Army ordered two new prototypes in November, 1956 for evaluation under service conditions. Each will be powered by three Nelson H-56 engines, for increased safety, and will incorporate other design refinements.

HOWARD

HOWARD AERO, INC.

Head Office and Works: International Airport, San Antonio, Texas.

President: D. U. Howard.

Executive Vice-President: E. J. Swearingen.

Vice-President, Service Division: Thomas Carmichael.

Vice-President, Manufacturing Division: Landis Carr.

Howard Aero, Inc., was formed by Mr. D. U. Howard in 1947 as an aircraft service organization specialising in the business aviation market, and is now one of the largest companies of its kind in the world.

The Manufacturing Division of Howard Aero was formed in 1955 and its principal current product is the Super Ventura, a high-speed long-range transport designed and built specifically for business use. The Super Ventura is built around certain basic components of the Lockheed PV-1 Ventura; but all components are extensively modified, all systems are of entirely new design and manufacture, and the



The Howard Super Ventura Executive Transport (two 2,000 h.p. Pratt & Whitney R-2800 engines).

performance of the Super Ventura far exceeds that of the original PV-1.

The first completed Super Ventura made its first flight in May, 1955, and the first production aircraft was delivered in the autumn of the same year to Plymouth Oil Company of Pittsburgh,Penna. Since then Super Venturas have been ordered by a large number of other major U.S. corporations.

THE HOWARD SUPER VENTURA.

TYPE.—Twin-engined Executive Transport.

WINGS.—Mid-wing cantilever monoplane. Wing section NACA 23018 at root, NACA 23009 at tip. Aspect ratio 7.08. Chord 13 ft. 9 in. (4.19 m.) at root, 3 ft. 9 in. (1.14 m.) at tip. Dihedral 6° 15′. Incidence 2°. Aluminium-alloy structure. Standard PV-1 aluminium-alloy ailerons. Aluminium-alloy Fowler-type flaps. Total area of ailerons 35.05 sq. ft. (3.25 m.²). Total area of flaps 107.5 sq. ft. (9.98 m.²). Gross wing area 542.9 sq. ft. (50.44 m.²).

FUSELAGE.—Aluminium-alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Aluminium-alloy construction. Areas: fins 29.28 sq. ft. (2.72 m.²), rudders 34.83 sq. ft. (3.23 m.²), tailplane 90.63 sq. ft. (8.42 m.²), elevators 35.32 sq. ft. (3.28 m.²). Tailplane span 23 ft. 2 in. (7.06 m.²).

LANDING GEAR.—Retractable tail-wheel type. Bendix PV-2 type pneumatic shock-absorbers. Hydraulic retraction. Goodyear PV-2 type wheels and brakes. Wheel track 15 ft. 4½ in. (4.67 m.). Wheelbase 39 ft. 1 in. (11.91 m.).

POWER PLANT.—Two 2,000 h.p. Pratt & Whitney R-2800-83AM10 eighteen-cylinder two-row air-cooled radial engines driving three-blade Hamilton Standard Type 23E50-6801A-54S airscrews, or two 2,400 h.p. Pratt & Whitney R-2800-83AM5 engines driving four-blade Hamilton Standard Type 24E60-7037A-50 airscrews. Fuel in six tanks, two front (155 U.S. gallons = 586 litres each) and two rear (175 U.S. gallons = 664 litres each) in centre-section and two outer wing tanks (345 U.S. gallons = 1,305 litres each). Total fuel capacity 1,350 U.S. gallons (5,110 litres). Oil capacity 26 U.S. gallons (98.2 litres) per engine.

ACCOMMODATION.—Eight to fifteen passengers.

DIMENSIONS.—
Span 62 ft. 0 in. (18.90 m.).
Length 57 ft. 2 in. (17.42 m.).
Height 12 ft. 6 in. (3.81 m.).

WEIGHT.—
Weight loaded 31,000 lb. (14,060 kg.).

PERFORMANCE.—
Max. cruising speed 300 m.p.h. (483 km.h.).

HUGHES

HUGHES TOOL COMPANY, AIRCRAFT DIVISION.

HEAD OFFICE AND WORKS: CULVER CITY, CALIFORNIA.

Although this company is new to aircraft design, it has at its disposal the experience gained by the entirely- separate Hughes Aircraft Company, whose post-war projects included the XH-17 flying crane, largest helicopter yet built. Hughes Aircraft Company is now engaged solely in the development and manufacture of electronics equipment.

Hughes Tool Company has designed and built as a private venture an ultra-light two-seat helicopter known as the Model 269, which is suitable for both military and civil use. The company is also engaged on research in connection with high-speed rotors, design and development of a hot-cycle pressure-jet rotor system, a helicopter propulsion system study and a heavy-lift flying crane parametric design study.

THE HUGHES MODEL 269.

Design and development of the Hughes Model 269 two-seat ultra-light helicopter began in September, 1955 and the first of two prototypes was test flown only 13 months later. Before the end of 1956, it had completed its major flight test programme and had been demonstrated to a preliminary military evaluation team. The second prototype has been used for tethered endurance tests.

The design emphasis was on simplicity to keep initial and operating costs to a minimum; and the Model 269 is claimed to handle with extreme ease and to have shown remarkable stability.

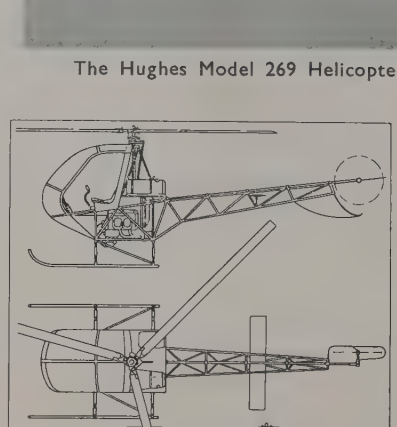
TYPE.—Two-seat Ultra-light helicopter.

ROTOR SYSTEM.—Three-blade main rotor with fully-articulated metal blades. Blades are of bonded construction, with constant-section extruded aluminium spar, wrap-around skin and a trailing-edge section. Blade section NACA 0015. Blade chord 6.75 in. (0.17 m.). A Vee-belt drive system is used, eliminating need for conventional clutch. Two-blade teetering-type tail anti-torque rotor, shaft-driven directly from belt-drive.

FUSELAGE.—Open steel-tube structure, with reinforced sheet metal seats and floor and light Plexiglas canopy.



The Hughes Model 269 Helicopter (180 h.p. Lycoming O-360 engine).



The Hughes Model 269 Helicopter.

LANDING GEAR.—Skid-type, mounted on four shock-absorbers. Track 6 ft. (1.83 m.).

POWER PLANT.—One 180 h.p. Lycoming O-360-A1A four-cylinder horizontally-opposed air-cooled engine mounted by four bolts below seats. Gravity-feed fuel system. Fuel capacity 23.5 U.S. gallons (89 litres).

ACCOMMODATION.—Two seats side-by-side under Plexiglas canopy. No side doors. Seat belts and shoulder harness. Dual controls optional. Baggage capacity 100 lb. (45 kg.).

DIMENSIONS.—
Main rotor diameter 24 ft. 10 in. (7.57 m.).
Tail rotor diameter 3 ft. 3 in. (0.99 m.).
Fuselage length 22 ft. 4 in. (6.80 m.).
Height 8 ft. 4 in. (2.54 m.).

WEIGHTS.—
Weight empty 850 lb. (385 kg.).
Weight loaded 1,500 lb. (680 kg.).
Overload weight 1,750 lb. (794 kg.).

PERFORMANCE.—
Max. speed 95 m.p.h. (153 km.h.).
Cruising speed 75 m.p.h. (121 km.h.).
Rate of climb at S/L. 1,360 ft./min. (415 m./min.).
Normal range 170 miles (275 km.).
Normal endurance 2½ hours.

KAMAN

THE KAMAN AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: OLD WINDSOR ROAD, BLOOMFIELD, CONNECTICUT.

President: Charles H. Kaman.

The Kaman Aircraft Corpn. was formed on December 12, 1945, to develop a new helicopter intermeshing rotor and servo flap control system evolved by Mr. Charles H. Kaman.

After proving the efficiency of this system on various experimental and limited-production helicopters, Kaman received U.S. Navy contracts in 1950 for undisclosed quantities of HTK-1 three-seat trainers and HOK-1 four-seat liaison helicopters.

Production of the HOK-1 for the U.S. Navy and Marine Corps continued through 1956 when this aircraft was also evaluated, by the U.S. Army.

In addition, Kaman continued development work on a variety of projects, including experiments in the remote-control helicopter field and the use of gas-turbines as helicopter power plants. As a result of the latter work, the company received a U.S. Navy contract to develop a single-rotor utility helicopter with a gas-turbine engine. It is also engaged on a design study for the U.S. Army of a large "flying crane" helicopter capable of carrying bulk items of heavy cargo over distances of 10 to 100 miles (16-160 km.).

On June 26, 1957, it was announced that Kaman had won a U.S.A.F. design contest for a local crash-rescue helicopter based on the HOK-1. The company is also developing an STOL aircraft for the U.S. Navy Bureau of Aeronautics.

Kaman is manufacturing components for the McDonnell RF-101 reconnaissance fighter and tools for the Grumman and Martin companies.

Under contract to the U.S. Navy Office of Naval Research, it has developed a rotorchute for the standard military M2 air-drop container, and a description of this appeared in the 1956-57 edition of "All the World's Aircraft."

The company is also active in the special weapons field and the formation

of a new Nuclear Division, located at Albuquerque, New Mexico, was announced in the winter of 1956-57. This Division will engage in systems analysis and research in the fields of nuclear ordnance and propulsion.

THE KAMAN HU2K-1.

Kaman entered two designs for a U.S. Navy design competition for a utility helicopter, one with intermeshing rotors and the other with a conventional single rotor. The latter was chosen, against strong industry competition, and is now under development to a Navy contract as the HU2K-1. Powered by a General Electric T58 gas-turbine, it will be the first single-rotor helicopter built by Kaman.

THE KAMAN HTK-1.

The HTK-1 (Kaman Model K-240) three-seat helicopter has been in service with the U.S. Navy and Marine Corps since early 1952. Used primarily as a trainer, it is adaptable as an ambulance and has been used for anti-submarine activities from the deck of LST's.

It uses the contra-rotating and intermeshing twin rotor system, with servo-flap control, which has been the feature of all Kaman helicopters prior to the HU2K-1.

In this system the solid spruce rotor blades are attached to the hub only by blade lag hinges, the servo flaps eliminating blade-pitch change and associated bearings. The movements of the servo flaps twist the blades, the natural resilience of the blade material being used to obtain torsional deflection.

The HTK-1 also has a horizontal tail surface connected to the collective-pitch control for greater stability to permit "hands-off" flying.

Power is supplied by a 240 h.p. Lycoming O-435 engine.

For evacuation duties the HTK-1 can carry a pilot and two stretcher cases, one above the other on the left side of the cabin. The left half of the transparent cabin nose opens to facilitate the loading of the stretchers. The change-over from three-seat trainer to ambulance can be made in 2½ minutes.

This helicopter has been awarded a C.A.A. Approved Type Certificate (1H3).

DIMENSIONS.—
- Rotor diameter (both) 41 ft. (12.50 m.).
- Distance between rotor heads 4 ft. 10 in. (1.47 m.).
- Length of fuselage (over fins) 20 ft. 6½ in. (6.25 m.).
- Span of tail 8 ft. 0 in. (2.44 m.).
- Wheelbase 6 ft. 2 in. (1.88 m.).
- Track (rear wheels) 7 ft. 6 in. (2.28 m.).
- Track (front wheels) 5 ft. 2 in. (1.57 m.).

WEIGHTS.—
- Combat weight (pilot + 1 and 20 U.S. gallons of fuel) 2,750 lb. (1,248 kg.).
- Normal loaded weight (pilot + 1 and 40 U.S. gallons of fuel) 2,870 lb. (1,303 kg.).
- Max. loaded weight (pilot + 3 stretcher cases and 15 U.S. gallons of fuel) 3,100 lb. (1,407 kg.).

PERFORMANCE (at designed gross weight).—
- Max. speed 81 m.p.h. (130 km.h.).
- Max. rate of climb 1,050 ft./min. (320 m./min.).
- Hovering ceiling in ground effect 5,700 ft. (1,740 m.).
- Service ceiling 14,500 ft. (4,420 m.).

PERFORMANCE (at combat weight).—
- Max. speed 81 m.p.h. (130 km.h.).
- Max. rate of climb 1,300 ft./min. (396 m./min.).
- Hovering ceiling in ground effect 6,700 ft. (2,043 m.).
- Service ceiling 17,000 ft. (5,185 m.).
- Range 120 miles (193 km.).



The Kaman HTK-1 Training Helicopter. (*Gordon Williams*).

Under a joint Army-Navy development contract one HTK-1 has been fitted with two Boeing 502-2 shaft turbine engines in place of the single standard Lycoming piston engine. The two turbine engines, which together produce 380 shaft h.p., are placed side-by-side, a simple gear-box transferring the dual power to the standard HTK-1 rotor drive system.

Normally both turbines are used for vertical take-off and hovering with heavy loads, while one turbine is shut off for cruising in horizontal flight.

The turbine-powered HTK-1 made its first flight on March 26, 1954.

Kaman has also developed for the HTK-1 an automatic stabilization installation; and in late 1956 the U.S. Army Corps of Engineers awarded the company a contract to investigate the possibility of using a helicopter fitted with this equipment as an elevated target to assist surveying and topographic mapping operations in difficult country.

A number of photo-electric cells were mounted on the bottom of an HTK-1 in such a way that they would pick up a vertical beam of light from the ground. Linked to the helicopter's controls through the auto-stabilization system, they corrected any tendency for the aircraft to wander off the beam and it was found that the HTK-1 could be kept hovering at a height of 1,000 ft. (300 m.) within a 20 ft. (6 m.) circle for up to 20 min. above a pre-selected point on the ground, even in winds ranging from 20 to 30 m.p.h. (32-48 km.h.).

THE KAMAN "DRONE" HELICOPTER.

In August, 1952 the Office of Naval Research awarded Kaman a contract to develop a remotely-controlled helicopter. This aircraft, which is a modified HTK-1, made its first flight under remote control from a ground station in May, 1953, and by April, 1956 had progressed to the stage where subsequent flight testing could be entrusted to ground controllers with no piloting experience.

The "drone" helicopter has demonstrated its ability to perform all normal helicopter manœuvres while being guided from a ground control station, an airborne control station mounted in another helicopter, or by "memory" fed into either the ground or airborne stations. To comply with safety regulations, all flights were originally made with a pilot aboard but he did not operate the controls. The first flight without a safety pilot aboard was made on July 30, 1957, when the "drone" was put through a complete series of flight manœuvres under the remote control of an operator who is not a pilot.

Simulated operational missions performed by the "drone" have included battle-field surveillance through the medium of television, the laying of communication cables, transporting cargo and unloading it automatically in otherwise inaccessible areas, and photo-reconnaissance.

Its use in war would avoid risking the lives of aircrew in hazardous operations. In addition, a specially-designed "drone" would be simple and lightweight, because the safety devices and structural strength needed in a manned helicopter could be eliminated.

As a result of this experimental work, Kaman was awarded a joint Navy-Army contract for an evaluation batch of three more "drone" helicopters in June, 1955.

THE KAMAN HOK.

The HOK is a four or five-seat general purpose helicopter which is in production for the U.S. Navy and Marine Corps. This contract was the result of success in a Navy-sponsored design competition for a liaison-type helicopter.

The HOK normally carries four or five persons but can be used also for cargo carrying, medical evacuation, search and rescue and air-to-ground photography. As an ambulance it can accommodate two stretcher patients and one sitting patient or medical orderly, in addition to



The Kaman HOK-1 Utility Helicopter (600 h.p. Pratt & Whitney R-1340 engine). (*Gordon Williams*).

the pilot. Stretcher loading is through the nose. Optional equipment includes an externally-mounted hook for cargo hauling and a power hoist.

The HOK-1 is powered by a 600 h.p. Pratt & Whitney R-1340-48 radial engine which is mounted at the rear end of the fuselage at an angle of 35° from the horizontal to give direct drive to the dual rotor gear-box in the roof. The engine is fan-cooled with the shutter-controlled main air inlet between the rotor pylons. Large rear fuselage doors give complete access to the power-plant. Maximum fuel capacity is 100 U.S. gallons (378 litres).

The two rotors can be lined up parallel to each other fore and aft for stowage purposes.

Details of a new type of landing gear developed for the HOK were announced in May, 1956. Known as "bear-paws," they consist of small skis which are able to prevent the helicopter sinking into soft surfaces and so permit operation from snow, sand or mud. A float landing gear is also available.

The following versions of the HOK have been announced :—

HOK-1. Standard production version, first accepted for service with the U.S. Navy on April 28, 1953. In production.

HOK-3. Under contract to the U.S. Air Force through the Lycoming Division of AVCO, Kaman modified an HOK-1 as a test-bed for the first flight tests of the Lycoming XT53 helicopter gas-turbine, and this aircraft made its first flight on September 27, 1956. Because of the relative simplicity of the modification needed to the HOK-1 airframe, the improvement in performance and payload, and the fact that the useable cabin space has been doubled by mounting the turbine above the fuselage, the U.S.A.F. has now ordered this version into production for the U.S. Army as the HOK-3. The HOK-3 will carry a pilot and either seven passengers, four litters and attendant or the equivalent weight in freight. Top speed will be over 132 m.p.h. (213 km.h.).

K-600. This is the designation of the commercial model of the HOK-1, which Kaman was first allowed to offer for civilian use in June, 1956.



The Kaman HOK-1 powered by a Lycoming XT53 shaft turbine, the prototype of the HOK-3.

K-600-3. Civil designation of HOK-3.

K-600-4. Designation of development of HOK-3 with Blackburn-Turbomeca Twin Turmo 600 shaft-turbine power-plant. Under evaluation by Canadian Services.

DIMENSIONS.—
Rotor diameter 47 ft. (14.33 m.).
Fuselage length 25 ft. (7.62 m.).
Height to tip of highest blade 15 ft. 6½ in. (4.73 m.).

WEIGHTS (K-600).—
Weight empty 4,040 lb. (1,833 kg.).
Normal weight loaded 5,800 lb. (2,631 kg.).
Max. weight loaded 6,800 lb. (3,084 kg.).

WEIGHTS (K-600-4).—
Weight empty 3,955 lb. (1,794 kg.).
Weight loaded (2 seats) 5,755 lb. (2,610 kg.).
Weight loaded (5 seats) 6,295 lb. (2,855 kg.).
Weight loaded (with 3,000 lb.=1,360 kg. freight) 7,725 lb. (3,504 kg.).

PERFORMANCE (K-600, at 5,800 lb.=2,631 kg. A.U.W.).—
Max. speed at 8,000 ft. (2,440 m.) 109 m.p.h. (176 km.h.).
Max. speed at S/L. 104 m.p.h. (167 km.h.).
Cruising speed (max. range) 75 m.p.h. (120 km.h.).
Cruising speed (max. endurance) 58 m.p.h. (93 km.h.).
Max. rate of climb 1,300 ft./min. (400 m./min.).
Vertical rate of climb 800 ft./min. (245 m./min.).
Service ceiling 18,000 ft. (5,500 m.).
Hovering ceiling with ground effect 12,000 ft. (3,660 m.).
Hovering ceiling out of ground effect 9,000 ft. (2,750 m.).
Range 220 miles (354 km.).
Endurance 3 hr. 20 min.

PERFORMANCE (K-600-4, at 6,295 lb.=2,855 kg. A.U.W.).—
Max. speed at S/L 114 m.p.h. (184 km.h.).
Max. speed at 6,000 ft. (1,830 m.) 119 m.p.h. (191 km.h.).
Vertical rate of climb at S/L 1,360 ft./min. (415 m./min.).
Max. rate of climb at S/L 1,670 ft./min. (510 m./min.).
Absolute hovering ceiling 15,200 ft. (4,630 m.).
Service ceiling 20,600 ft. (6,280 m.).
Range at 105 m.p.h. (169 km.h.) 198 miles (319 km.).
Endurance at 50 m.p.h. (82 km.h.) 2 hr. 20 min.

KELLETT

THE KELLETT AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS : P.O. Box 35, WILLOW GROVE, PENNSYLVANIA.

President : J. T. Duffy, Jr.

Vice-Presidents : P. E. Hovgard, Lance Call and I. Medgebow.

Chief Engineer : C. E. Schneck.

Director of Research : Leonard Goland.

Plant Manager : H. J. Pelkey.

Treasurer and Controller : J. N. Brown.

Secretary : G. P. Williams III.

The Kellett Aircraft Corporation was founded in 1929, and has since been engaged in the development of rotary-wing aircraft.

The Company is currently working on eight research and development projects in conjunction with the Armed Services. The projects deal primarily with the many aspects of the VTOL aircraft and the Kellett gyro stabilizing system as applied to service type aircraft.

Kellett moved into a new plant at Willow Grove, Pennsylvania, in November, 1956. The new plant houses all the company's activities under one roof and provides modern accommodation for engineering, manufacturing and flight test operations.

The Company continues to be engaged in sub-contract work on components for aircraft companies throughout the United States.



The Kellett KH-15 Rocket-driven Research Helicopter.

THE KELLETT KH-15.

The KH-15 is a single-seat rocket-driven research helicopter which was developed under the joint sponsorship of the Air Branch, Office of Naval Research, and the U.S. Army for in-flight investigation of a gyratory stabilised control system developed by Kellett.

The prototype made its first flight on May 13, 1954.

The KH-15 was designed to allow a large variation of the control parameters affecting the control and stability characteristics of a helicopter. Thus, a large number of control combinations can be set up and tested without modification to the basic structure.

The prototype has displayed remarkable stability and control characteristics as demonstrated by its ability to be flown

"hands-off" for periods of up to four minutes.

TYPE.—Single-seat Research helicopter.

ROTOR SYSTEM.—Two-bladed main rotor, with tubular steel spars, birch plywood ribs and mahogany plywood skin. Blades attached to hub through thrust bearings. Hub articulated in flapping plane. Area of each main rotor blade 4.5 sq. ft. (0.42 m.²). Total disc area 254.4 sq. ft. (23.63 m.²). Two-bladed solid wood variable-pitch anti-torque rotor with total disc area of 4.9 sq. ft. (0.455 m.²).

ROTOR DRIVE.—Tip-driven rotor.

FUSELAGE.—Open steel-tube frame.

LANDING GEAR.—Fixed tubular steel tripod with pneumatic landing pads.

POWER PLANT.—Two Reaction Motors Type TU-111 rocket motors, each giving 24 lb. (10.89 kg.) s.t., mounted in tips of rotor blades. Over 17 U.S. gallons (64 litres) of fuel in two laterally-disposed spherical tanks. Hydrogen peroxide fuel. Tanks pressurised with nitrogen. System incorporates a pilot-operated manual throttling valve.

DIMENSIONS.—
Diameter of main rotor 18 ft. (5.49 m.).
Diameter of tail rotor 2 ft. 3 in. (0.68 m.).
Overall length 18 ft. (5.49 m.).
Overall width (blades fore and aft) 8 ft. 1 in. (2.47 m.).
Max. height approx. 8 ft. (2.44 m.).

WEIGHTS.—
Weight empty 234 lb. (106 kg.).
T.O. weight 644 lb. (292 kg.).

PERFORMANCE.—
Cruising speed 60 m.p.h. (96.5 km.h.).
Range 16 miles (25.75 km.).

LAMSON

LAMSON AIRCRAFT COMPANY, INC.

HEAD OFFICE: 807, FOURTH AVENUE, SEATTLE, WASH.

WORKS: P.O. Box 1364, MUNICIPAL AIRPORT, YAKIMA, WASH.

President: James A. Clark, Jr.

Vice-President, Sales and Operations: Robert N. Ward.

Acting Secretary-Treasurer: R. R. James.

The Lamson Aircraft Company, Inc. is responsible for the manufacture of the Air Tractor which has been specially designed for all kinds of agricultural work, including dusting, spraying, seeding, fertilising, weed-killing, timber spraying, etc. Particular attention has been paid to evolving an aircraft which will be easy and cheap to maintain and operate. All four wing panels, the flaps and ailerons, interplane struts and all tail surfaces are identical and interchangeable.

The prototype Air Tractor flew for the first time on December 10, 1953, and the first production Air Tractor flew on December 18, 1954. Having completed its flight tests, this production aircraft is undergoing static testing. Production was suspended temporarily in the latter part of 1955, when four more aircraft were in various stages of construction, but was due to be resumed in 1957.



The Lamson Air Tractor (450 h.p. Pratt & Whitney R-985 engine).

THE LAMSON MODEL L.101 AIR TRACTOR.

TYPE.—Single-engined Agricultural biplane.

WINGS.—Equal-span braced biplane. NACA 6515 high-lift wing section. Chord 5 ft. 6 in. (1.67 m.). Dihedral 4°. Incidence 8°. Gull-wing upper centre-section, rigidly-braced lower stub wings. All four outer wing panels identical and interchangeable, with attachment fittings at each end. N-type interplane struts. Double wire-bracing in planes of upper and lower front spars. Large end-plates at wing tips. Trailing-edges of panels hinged, upper hinged surfaces acting as ground-adjustable flaps and lower surfaces as ailerons. All four hinged surfaces are identical and interchangeable. Wing structure of wood with fabric covering. Total aileron area 44.2 sq. ft. (4.1 m.²). Gross wing area 350 sq. ft. (32.5 m.²).

FUSELAGE.—Welded steel-tube rigidly-braced framework covered with aluminium sheet.

TAIL UNIT.—Braced monoplane type. All surfaces, fixed and movable, identical and interchangeable, special hinges making it impossible to instal incorrectly. Welded steel-tube frames covered with fabric. Areas: fin 12.8 sq. ft. (1.18 m.²). rudder 12.8 sq. ft. (1.18 m.²), tailplane 25.6 sq. ft. (2.36 m.²), elevators 25.6 sq. ft. (2.36 m.²). Span of tail 13 ft. (3.96 m.).

LANDING GEAR.—Fixed tail-wheel type. Bendix air-oil shock-absorbers. Goodyear wheels and single or multiple disc brakes. Track 10 ft. 8 in. (3.25 m.).

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 nine-cylinder radial air-cooled engine. Hamilton Standard 2D30 two-blade variable-pitch airscrew. Fuel tank in fuselage, capacity 84 U.S. gallons (317.5 litres).

ACCOMMODATION.—Open pilot's cockpit aft of trailing-edge of lower wings. Fuselage hopper of up to 50 cub. ft. capacity for 2,000 lb. (908 kg.) of dust or spray.

DIMENSIONS.—
Span 33 ft. 7 in. (10.24 m.).
Length 26 ft. 8 in. (8.13 m.).
Height 11 ft. 3 in. (3.43 m.).

WEIGHTS.—
Weight empty 2,970 lb. (1,348 kg.).
Weight loaded 5,500 lb. (2,497 kg.).

PERFORMANCE (with 2,000 lb.=908 kg. of chemicals).—
Take-off run 990 ft. (302 m.).
Rate of climb (Temperature 50°F., wind 0-2 m.p.h., altitude of field 1,070 ft.=375 m.) 450 ft./min. (137 m./min.).
Landing run 950 ft. (290 m.).

PERFORMANCE (with 1,500 lb.=680 kg. of chemicals).—
Take-off run 410 ft. (125 m.).
Rate of climb 950 ft./min. (290 m./min.).
Landing run 390 ft. (119 m.).

LARSON

LARSON AERO DEVELOPMENT.

HEAD OFFICE AND WORKS: BUCHANAN FIELD, CONCORD, CALIFORNIA.

Larson Aero Development has produced the prototype of an easy-to-maintain agricultural aircraft for spraying duties. Designated the Larson D-1, it made its first flight on March 30, 1955.

THE LARSON D-1.

TYPE.—Single-seat Agricultural Biplane.

WINGS.—All-metal strut-braced biplane. Wing section Goettingen 365 (modified). Aspect ratio 6. Chord 60 in. (1.52 m.). Dihedral 0° on top wing, 1° on lower wing. No incidence. Aluminium structure and skin. Ailerons are also of aluminium. No flaps are fitted. Aileron area 28 sq. ft. (2.60 m.²). Wing area 315 sq. ft. (29.3 m.²).

FUSELAGE.—Steel-tube structure, with centre portion only fabric-covered.

TAIL UNIT.—Fabric-covered strut-braced steel tube structure, with twin rudders. Areas: rudders 15 sq. ft. (1.39 m.²), elevators 25 sq. ft. (2.32 m.²), tailplane 18 sq. ft. (1.67 m.²). Tailplane span 12 ft. (3.66 m.).



The Larson D-1 Agricultural Biplane (225 h.p. Lycoming R-680 engine).

LANDING GEAR.—Fixed tail-wheel type, with Larson spring and oil main struts and bilateral spring tail suspension. Ford automobile wheels. Ford automobile brakes with Larson master cylinders. Wheel track 8 ft. (2.44 m.). Wheelbase 21 ft. 6 in. (6.55 m.).

POWER PLANT.—One 225 h.p. Lycoming R-680 nine-cylinder air-cooled radial engine, or 220 h.p. Continental R-670 seven-cylinder air-cooled radial engine, or 245 h.p. Jacobs R-755 seven-cylinder air-cooled radial engine. McCauley ground-adjustable airscrew with steel blades. One 30 U.S. gallon (114 litre) fuel tank in fuselage. Oil capacity 4.4 U.S. gallons (16.6 litres).

ACCOMMODATION.—Pilot only, in high-set open cockpit.

DIMENSIONS.—
Span 33 ft. (10 m.).
Length 27 ft. (8.23 m.).
Height 11 ft. (3.35 m.).

WEIGHTS.—
Weight empty 1,900 lb. (862 kg.).
Weight loaded 3,600 lb. (1,633 kg.).

PERFORMANCE (Lycoming R-680 engine).—
Cruising speed at S/L. 90 m.p.h. (145 km.h.).
Landing speed 40 m.p.h. (64 km.h.).
Rate of climb at S/L. (empty) 1,400 ft./min. (425 m./min.).
Take-off run, empty, no wind, under 200 ft. (60 m.).
Take-off run with 1,000 lb. (454 kg.) payload, no wind, 600 ft. (183 m.).



The Learstar Mk. I Executive Transport (two 1,425 h.p. Wright R-1820-76A engines).

PACAERO ENGINEERING CORPORATION.

OFFICE and WORKS: 3021 AIRPORT AVENUE, SANTA MONICA, CALIFORNIA.

In 1957 the Aircraft Engineering Division of Lear, Inc. was taken over by Pacific Airmotive Corporation, which formed a new subsidiary, PacAero Engineering Corporation, to continue the manufacture of the Learstar executive transport. PacAero occupies facilities covering 240,000 square feet on Santa Monica airport where, in addition to the production of the Learstar, it will provide complete repair and maintenance service for Learstar and Lodestar owners, and will continue overhaul, modification and re-manufacture of all types of single and multi-engined aircraft, the manufacture of ground support equipment, etc.

The Learstar was originally evolved by the Aircraft Engineering Division of Lear, Inc. in 1953 as a high-speed long-range custom-equipped executive transport specifically for use by business firms and individuals. It is built around certain basic components of the Lockheed Model 18-56 Lodestar. All such components are, however, extensively modified, all operating systems of the aircraft are of entirely new design and construction, and the performance of the aircraft far exceeds that of the Lodestar.

The first prototype Learstar made its initial flight May 19, 1954, and the first production aircraft flew on October 19, 1954. In January, 1955, the Learstar Mk. I was certificated by the C.A.A. in the Airline Transport Category, and the first delivery was made on February 26, 1955. The first Mk. II version was granted a supplemental Type Certificate in July, 1956.

THE LEARSTAR MARK I.

TYPE.—Twin-engined Executive Transport.

WINGS.—Low-wing cantilever monoplane. NACA 2300 Series (modified) wing section. Aspect ratio 7.79. Chord 13 ft. 9.3 in. (4.19 m.) at root, 4 ft. 0.8 in. (1.22 m.) at tip. Dihedral 6° 15′ at chord line. Incidence 2°. Aluminium-alloy flush-riveted structure. All-metal ailerons with trim and balance tabs. All-metal Fowler type flaps inboard of ailerons. Total area of ailerons 35 sq. ft. (3.25 m.²). Total area of flaps 107.5 sq. ft. (9.98 m.²). Gross wing area 551 sq. ft. (51.18 m.²).

FUSELAGE.— Aluminium - alloy monocoque structure with flush-riveted skin.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Aluminium-alloy construction. Areas: fins (2) 29.3 sq. ft. (2.72 m.²), rudders (2) 34.8 sq. ft. (3.23 m.²), tailplane 82.6 sq. ft. (7.66 m.²), elevators (total) 40.4 sq. ft. (3.75 m.²). Span of tailplane 23 ft. 2 in. (7.06 m.).

LANDING GEAR.—Retractable or non-retractable, nose-wheel or tail-wheel type, to customer's preference. Cleveland Pneumatic air-oil shock-absorbers. Hydraulic retraction. Goodyear wheels and single-disc spot-type brakes. Track 15 ft. 4 in. (4.67 m.). Wheelbase 35 ft. 3 in. (10.74 m.).

POWER PLANT.—Two Wright Cyclone R-1820-76A nine-cylinder radial air-cooled engines each rated at 1,425 h.p. for T.O. and 1,275 h.p. METO. Hamilton Standard Type 33D50-101/6511-12A airscrews. Fuel in six tanks, two front main (150 U.S. gallons = 567 litres each) and two rear main (172 U.S. gallons = 650 litres each) in centre-section and two outer wing tanks (235 U.S. gallons = 888 litres each). Total internal fuel capacity 1,114 U.S. gallons (4,255 litres). Optional outer wing tanks provide additional 200 gallons (755 litres) of fuel. Oil capacity 38 U.S. gallons (144 litres).

ACCOMMODATION.—Crew of 2 and 8 to 12 passengers. Cabin furnishings and equipment according to customer's requirements. Toilet and galley.

EQUIPMENT.—Weather and ground mapping radar is available as optional equipment. This is housed in a nose radome which fairs perfectly into the aerodynamic contours of the fuselage.

DIMENSIONS.—
Span 66 ft. 2 in. (20.16 m.).
Length 51 ft. (15.55 m.).
Length (with radar nose) 55 ft. 6 in. (16.90 m.).
Height 11 ft. 10 in. (3.60 m.).

WEIGHTS.—
Weight empty approx. 15,000 lb. (6,804 kg.).
Weight loaded 24,000 lb. (10,886 kg.).

PERFORMANCE.—
Max. speed 321 m.p.h. (514 km.h.).
Cruising speed (55% power) at 10,000 ft. (3,050 m.) 280 m.p.h. (448 km.h.).
Stalling speed with flaps 94.2 m.p.h. (151.5 km.h.).
Rate of climb at S/L. 1,494 ft./min. (455 m./min.).
Service ceiling at gross loading 22,950 ft. (6,995 m.).
Single-engine ceiling at gross loading 8,380 ft. (2,555 m.).
Range 3,800 miles (6,080 km.), 4,300 miles (6,920 km.) with optional wing tanks.

THE LEARSTAR MARK II.

The Learstar Mark II conversion is designed primarily for application to extensively-equipped executive Lodestars and does not disturb existing interiors, radio or instrumentation. It includes all the advanced safety features of the Learstar Mark I and virtually all its performance features.

WEIGHTS.—
Take-off weight 22,500 lb. (10,215 kg.).
Landing weight 20,400 lb. (9,261 kg.).

PERFORMANCE.—
Max. cruising speed 290 m.p.h. (464 km.h.) at 10,000 ft. (3,050 m.).
Normal cruising speed 270 m.p.h. (432 km.h.) at 10,000 ft. (3,050 m.).
Range at normal cruising speed 2,500 miles (4,000 km.).



The Learstar Mk. I Executive Transport (two 1,425 h.p. Wright R-1820 engines).

LOCKHEED

LOCKHEED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: BURBANK, CALIFORNIA.

OTHER CALIFORNIA DIVISION FACTORIES: BAKERSFIELD, MAYWOOD AND PALMDALE, CALIFORNIA.

GEORGIA DIVISION: MARIETTA AND DAWSONVILLE, GA.

MISSILE SYSTEMS DIVISION: VAN NUYS AND SUNNYVALE, CALIFORNIA.

Incorporated: 1932.

Chairman of Board and Chief Executive: Robert E. Gross.

President: Courtlandt S. Gross.

Executive Vice-President: Daniel J. Haughton.

Senior Vice-President: Cyril Chappellet.

Senior Vice-President: Hall L. Hibbard.

Senior Vice-President: C. A. Barker, Jr.

Vice-President and Assistant to Chairman: Carl B. Squier.

Vice-President and General Manager, California Division: Burt C. Monesmith.

Vice-President and General Manager, Georgia Division: A. Carl Kotchian.

Vice-President and General Manager, Missile Systems Division: Eugene Root.

Vice-President, Engineering and Research: C. L. Johnson.

Vice-President, Administration: Don Cameron.

Vice-President, Finance and Comptroller: Dudley E. Browne.

Treasurer: Frank L. Frain.

The original Lockheed Aircraft Co. dates from 1916 when the brothers Allen and Malcolm Loughead, the founders, began with what was the forerunner of the true streamline aeroplane. The factory was moved to Burbank, Cal., the present site, in 1926, and the name changed to Lockheed.

On November 30, 1943, the Vega Aircraft Corporation, which had been formed in 1937 as an affiliate and in 1941 became a wholly-owned subsidiary of the Lockheed Aircraft Corpn., was absorbed and the name Vega abandoned.

The company now employs around 61,000 persons, including about 19,000 at its Marietta, Ga., division, which occupies a World War II government-owned plant.

By the time Lockheed had celebrated its 25th anniversary in 1957 it had built nearly 30,000 aircraft of seventy different types.

Lockheed's current production includes the single-seat F-104A and two-seat F-104B air superiority fighters for the U.S.A.F., the T-33A jet trainer for the U.S.A.F. (and numerous N.A.T.O. countries); the TV-2 and T2V-1 jet trainers for the U.S. Navy; the P2V Neptune for the U.S. Navy; the WV-2 and EC-121 radar warning aircraft for the U.S. Navy and U.S.A.F. respectively; the WV-3 weather reconnaissance version for the U.S. Navy; the U-2 high-altitude research aircraft; the Super Constellation in passenger and cargo versions for airlines and the military services; the Model 1649A Starliner and turboprop-powered Electra 188 for airlines; and the C-130 turboprop-powered medium cargo transport for the U.S.A.F.

In addition, the company has built a new 10-passenger twin-jet transport aircraft named the JetStar for civil and military use, the prototype of which flew for the first time on September 4, 1957.

A total of more than 900 Constellation series aircraft, both military and civil, have been built or are on order. In 1957 commercial Super Constellations were still coming off the production lines steadily, while military orders in hand extend through 1958.

Considerable research work in advanced flight fields is under way, and it was announced in the Spring of 1956 that many millions of dollars are to be spent on facilities and equipment to adapt the Georgia Division for work connected with the development of nuclear-powered aircraft. In conjunction with the U.S.A.F., a start has been made on a nuclear aircraft testing and research facility on a 10,000-acre tract near Dawsonville, Ga., where some 500 scientists, engineers and technicians will work.

A new division, the Missile Systems Division, was formed in November, 1953, to bring together various projects and their staffs for intensive design, development and production work on pilotless aircraft and missiles. Previously such work was accomplished by separate specialized groups which concentrated on individual projects. This division is extending its activities to Sunnyvale and Palo Alto, California, while retaining its original Van Nuys plant.

Among the facilities of the Missile Systems Division is a newly-opened laboratory in Stanford University's "industrial park", where experimental nuclear reactor components will be assembled for tests under simulated operating conditions.

During 1956, three new products of the Missile Systems Division were launched for the first time. They consisted of one as yet unidentified missile; the X-7, a winged test vehicle used in the development of ramjet engines and missile components; and the X-17, a three-stage ballistic rocket intended to provide at relatively low cost information on the problems which arise when the warhead of a ballistic missile re-enters the earth's atmosphere at exceptionally high speed. Both are described in the "Guided Missiles" section of this work.

THE LOCKHEED CL-329 JETSTAR.

First announced in March, 1957, and built as a private venture, the prototype of the JetStar flew on September 4, 1957, only 241 days after its basic design was finalised. It is a jet-powered light executive transport of conventional all-metal low-wing monoplane design, with accommodation for a crew of two and ten passengers. There is stowage space for coats at the rear of the cabin, a fully-equipped washroom aft, and luggage space both forward and aft of the cabin. Comprehensive radio and radar navigation equipment are standard.

The wings are swept back at 34° and have an area of 523 sq. ft. (48.6 m.²). The fin and high-set all-flying tail are built in one piece and move together. The cabin is pressurised to the equivalent of 8,000 ft. (2,440 m.) altitude at 45,000 ft. (13,700 m.).

The first prototype JetStar is powered by two Bristol Orpheus turbojets, mounted on each side of its rear fuselage, but production models can have as an alternative four lower-powered General Electric J85 or Fairchild J83 turbojets mounted in lateral pairs in the same position. The JetStar will thus meet the requirements of the U.S.A.F.'s UC/X specification for a four-jet aircraft for transport, crew-readiness training and other duties, in addition to its civil applications.

DIMENSIONS.—
Span 53 ft. (16.15 m.).
Length 58 ft. (17.68 m.).
Height 21 ft. (6.40 m.).

WEIGHTS.—
No data available.

PERFORMANCE.—
Cruising speed at 25,000-45,000 ft. (7,620-13,700 m.) 500-550 m.p.h. (805-885 km.h.).
Max. stage length 2,000 miles (3,220 km.).

THE LOCKHEED HERCULES.

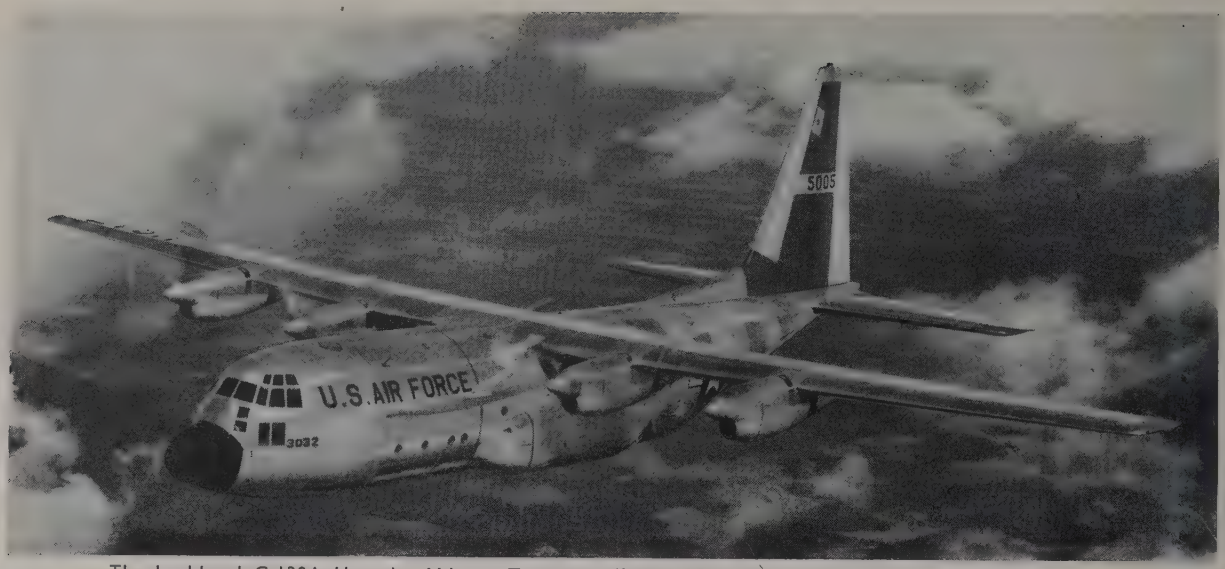
U.S.A.F. designation: C-130.

The C-130 is a medium assault transport for the movement of military personnel and material, and their delivery by landing or parachute as required. It can be converted rapidly into an ambulance for evacuation of wounded on return flights.

Aft of the main hold, the rear fuselage is sharply upswept. In the upswept portion is a built-in loading ramp which serves as the rear door. This ramp can be lowered to truck-bed height for loading stores, or to the ground for wheeled and tracked vehicles to be driven in. The rear door can also be opened in flight for the air dropping of paratroops and equipment. There is also a large cargo-loading door ahead of the wings.



The prototype Lockheed CL-329 JetStar Light Executive Transport (two Bristol Orpheus turbojet engines).



The Lockheed C-130A Hercules Military Transport (four 3,750 e.s.h.p. Allison T56 turboprop engines).

The retractable tricycle landing gear, with the main wheels in tandem, is designed to permit the C-130 to operate from small emergency landing fields or rough forward airstrips. There is provision for eight 1,000 lb. (455 kg.) thrust JATO units in the main landing gear fairings.

The C-130 was designed to a specification issued by the U.S.A.F. Tactical Air Command in 1951, and Lockheed were awarded a prototype contract on September 19, 1952. The following versions have been announced :—

YC-130. The first prototype under this designation flew on August 27, 1954.

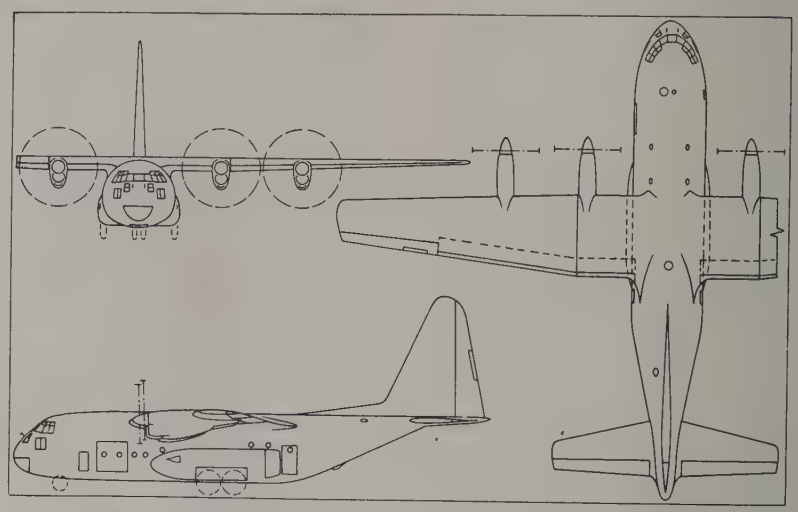
C-130A. Initial production version with four 3,750 h.p. Allison T56-A-1 turboprops. First flown on April 7, 1955. Deliveries of this version to U.S.A.F. began in December, 1956. Twelve ordered for Royal Australian Air Force.

C-130B. Developed version, with loaded weight of 135,000 lb. (61,235 kg.) additional 1,820 U.S. gallons (6,887 litres) of fuel in wings inboard of inner engine nacelles, strengthened landing gear and four 4,050 h.p. Allison T56-A-7 turboprops, driving four-blade Aeroproducts airscrews.

Lockheed have applied to the C.A.A. for certification of a commercial version of this design under the company designation Model GL-108.

A test version of the C-130A equipped with a combination wheel-ski landing gear flew for the first time on January 29, 1957. A flight refuelling tanker version was sent to Patuxent River, Maryland, in the Summer of 1957 for evaluation prior to acceptance by the U.S. Marine Corps.

The following description refers to the C-130A.



The Lockheed C-130A Hercules Medium Assault Transport.

TYPE.—Medium Assault Transport.

WINGS.—Cantilever high-wing monoplane. Aspect ratio 10. Dihedral 2½°. Mean chord 13 ft. 8½ in. (4.16 m.). All-metal two-spar structure, with integrally-stiffened tapered machined skin panels up to 48 ft. (14.63 m.) long. Thermal de-icing on leading-edge. Gross wing area 1,745 sq. ft. (162.12 m.²).

FUSELAGE. — All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Thermal de-icing on tailplane leading-edge.

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Each main wheel unit has two tandem wheels which retract into fairings built onto the sides of the fuselage. Nose unit has twin wheels and is steerable through 60° each side of centre. Wheel track 14 ft. 3 in. (4.35 m.). Special retractable combination wheel-skis available for arctic operation. Each main ski is 19 ft. 6 in. long by 5 ft. 6 in. wide (5.94 × 1.68 m.) and weighs 1,700 lb. (770 kg.). The nose ski measures 9 ft. 6 in. in length and 5 ft. 6 in. wide (2.90 × 1.68 m.). All three are sprung to provide 18 in. (0.46 m.) of upward and downward pitch at either end and have a bearing surface of Teflon plastic to reduce friction and resist the adhesiveness of ice.

POWER PLANT.—Four 3,750 e.s.h.p. Allison T56-A-1 turboprop engines in armoured nacelles. Aeroproducts three-blade constant-speed fully-feathering reversible-pitch airscrews, 15 ft. (4.6 m.) diameter. Eight Aerojet-General 15 KS-1000 JATO



The Lockheed C-130B Hercules (four 4,050 e.s.h.p. Allison T56-A-7 engines and 13 ft. 6 in. diameter paddle-blade airscrews).

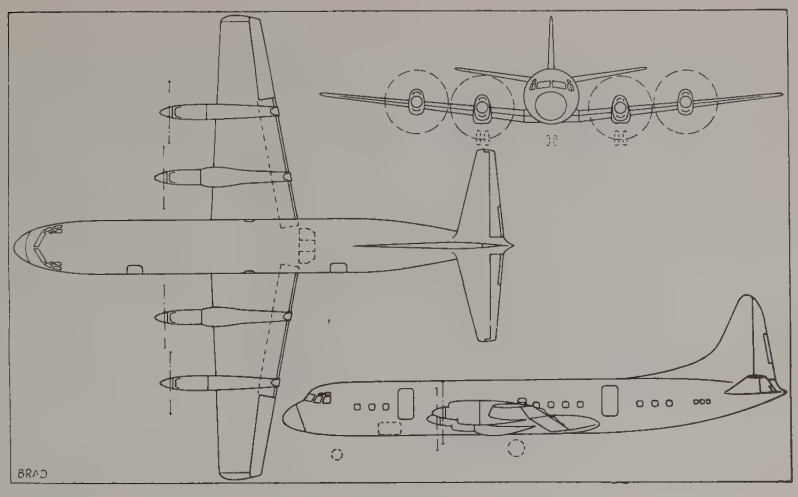
units (8 × 1,000 lb.=455 kg. thrust for 15 seconds) can be carried in the main landing gear fairings. Single-point pressure refuelling. Fuel in four main tanks, two in each wing, with a total capacity of 5,080 U.S. gallons (19,230 litres). Two underwing auxiliary tanks, each with a capacity of 1,400 U.S. gallons (5,300 litres), can also be carried, but the total allowable fuel capacity of all tanks is 5,300 U.S. gallons (20,060 litres). Oil capacity 32 U.S. gallons (121 litres).

ACCOMMODATION.—Pressurised accommodation for crew of four, comprising pilot, co-pilot, navigator and "systems manager". Maximum pressure differential 7½ lb./sq. in. (0.53 kg./cm.²). Pilot and co-pilot have armour protection against small arms fire. Flight deck and cabin air-conditioned in flight and on the ground. Power-assisted controls. Cargo compartment, also pressurised, is 41 ft. 5 in. long, 10 ft. 3 in. wide and 9 ft. 1 in. high (12.6 m. × 3.1 m. × 2.3 m.), with a maximum capacity of 4,300 cub. ft. (121.7 m.³) and normal usable capacity of 3,680-3,850 cub. ft. (104.2-109 m.³). All doors are 3 ft. 5 in. (1.03 m.) from the ground. Hydraulically-operated main loading door is 10 ft. × 9 ft. 2½ in. (3.05 m. × 2.8 m.); side cargo door is 6 ft. 8 in. × 6 ft. (2.04 m. × 1.83 m.); paratroop door is 3 ft. × 6 ft. (0.91 m. × 1.83 m.). Standard complements are as follows: Troops (max.) 92, Paratroops (max.) 64, Litters 74 and 2 attendants, Passengers 55, with provision for forward or rearward-facing seat. As a cargo carrier, loads can include heavy equipment such as a 26,640 lb. (12,080 kg.) Type F.6 refuelling trailer, nine Nike missiles and boosters, or a 155 mm. howitzer and its high-speed tractor.

DIMENSIONS.—
- Span 132 ft. 7 in. (40.25 m.).
- Length 97 ft. 8 in. (29.78 m.).
- Height 38 ft. 3½ in. (11.59 m.).

WEIGHTS.—
- Weight empty (normal) 59,800 lb. (27,125 kg.).
- Weight empty (max.) 63,800 lb. (28,940 kg.).
- Design A.U.W. (normal) 108,000 lb. (48,988 kg.).
- Design A.U.W. (overload) 124,200 lb. (56,340 kg.).
- Landing weight (normal) 96,000 lb. (43,540 kg.).
- Landing weight (max.) 110,000 lb. (49,900 kg.).

PERFORMANCE.—
- Max. speed over 370 m.p.h. (595 km.h.).
- Climb to 2,500 ft. (765 m.) with JATO 1 min..
- Service ceiling 40,000 ft. (12,190 m.).
- Take-off distance to 50 ft. (15.25 m.) at 120,000 lb. (54,430 kg.) A.U.W. 2,800 ft. (855 m.).
- Landing distance from 50 ft. (15.25 m.) at 100,000 lb. (45,360 kg.) A.U.W. 1,000 ft. (305 m.).



The Lockheed Electra Airliner.

- Range with 39,400 lb. (17,870 kg.) payload at 335 m.p.h. (539 km.h.) 1,940 miles (3,122 km.).
- Range with max. fuel and 31,500 lb. (14,288 kg.) payload at 335 m.p.h. (539 km.h.) 2,760 miles (4,442 km.).
- Range with max. fuel and 25,800 lb. (11,700 kg.) payload at 330 m.p.h. (531 km.h.) 2,880 miles (4,635 km.).

THE LOCKHEED 188A ELECTRA.

The Electra is a medium-range airliner which will be powered initially by four 3,750 e.s.h.p. Allison Model 501 (military designation T56) turboprop engines, but will be able to take engines developing up to 5,500 e.s.h.p. each. The prototype is scheduled to fly on January 31, 1958.

The initial order "off the drawing board" for 35 Electras was received from American Airlines in 1955 and actual construction of these aircraft began in October, 1956. Delivery will begin in the latter part of 1958 and all 35 are due to be delivered by the middle of 1959. Subsequent orders have been placed by the following airlines: Eastern Air Lines 40, with an option on 30 more; National Airlines 23; Braniff International Airways 9; K.L.M. 12; Western Air Lines 9; Loftleidir (Iceland) 2; Braathen's SAFE 1; Cathay Pacific Airways 2; Pacific Southwest Airlines 3; Garuda Indonesian Airways 3, Ansett Australian National Airways 3.

TYPE.—Four-engined Medium-range Airliner.

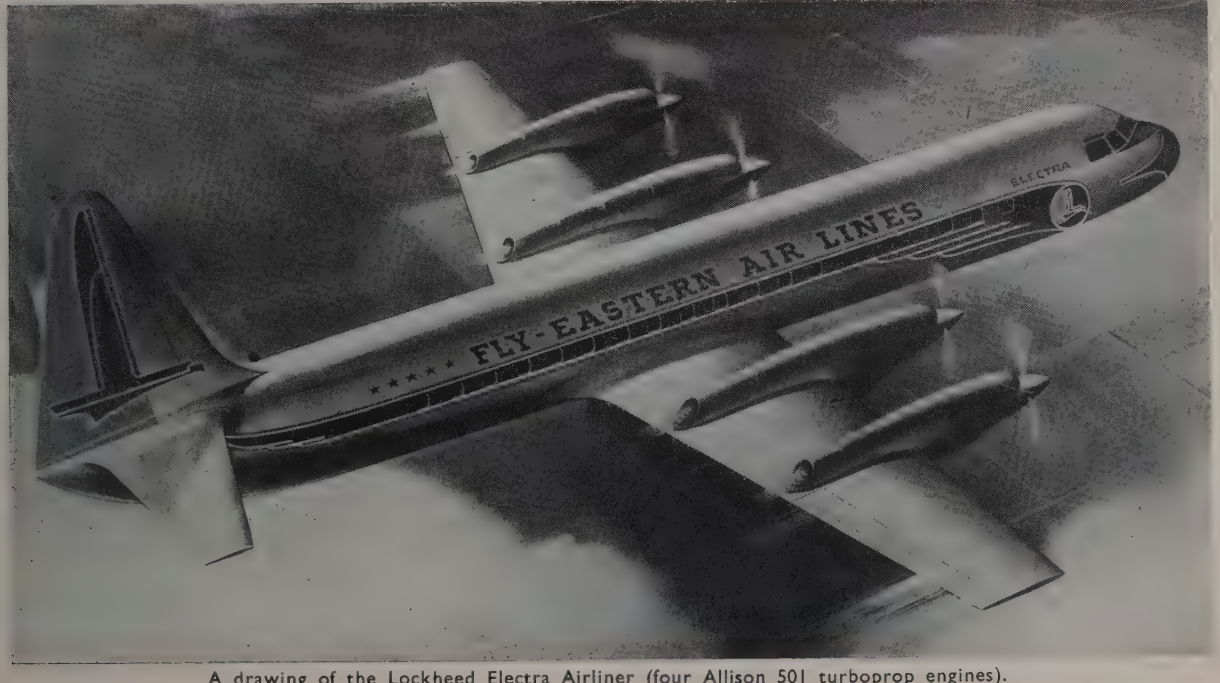
WINGS.—Cantilever low-wing monoplane. Wing section NACA 0014-1.10 at root, NACA 0012-1.10 at tip. Aspect ratio 7.5. Chord 18 ft. 11 in. (5.77 m.) at root, 7 ft. 7 in. (2.31 m.) at tip. Dihedral 6°. Incidence 3° at root, ½° at tip. Extruded and integrally-stiffened aluminium-alloy box beam structure. Conventional aluminium-alloy ailerons and high lift Fowler type flaps. Total aileron area 98 sq. ft. (9.10 m.²). Total flap area 208 sq. ft. (19.32 m.²). Gross wing area 1,300 sq. ft. (120.77 m.²).

FUSELAGE. — Aluminium-alloy semi-monocoque structure.

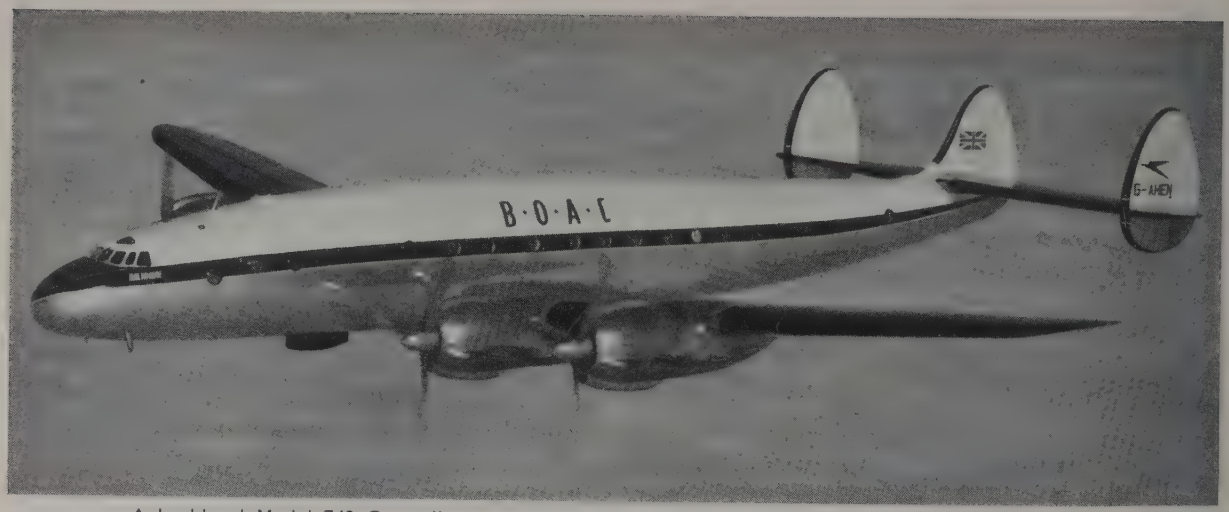
TAIL UNIT.—Aluminium-alloy cantilever monoplane type. Areas: fin 165 sq. ft. (15.33 m.²), rudder 47 sq. ft. (4.37 m.²), elevators 79 sq. ft. (7.34 m.²), tailplane 320 sq. ft. (29.73 m.²). Tailplane span 42 ft. 10 in. (13.06 m.).

LANDING GEAR.—Retractable tricycle type. Menasco oleo-pneumatic shock-absorbers. Hydraulic retraction. Wheel track 31 ft. 2 in. (9.50 m.). Wheelbase 37 ft. (11.28 m.).

POWER PLANT.—Four 3,750 e.s.h.p. Allison 501-D13 (later 4,050 e.s.h.p. Allison 501-D15) turboprop engines, giving 2,060 e.s.h.p. per engine for cruising at 20,000 ft. (6,100 m.). Aeroproducts or Hamilton Standard four-blade reversible-pitch airscrews, 13 ft. 6 in. (4.11 m.) diameter. Total fuel capacity 5,360 U.S. gallons (20,210 litres), in two 1,090 U.S. gallon (4,127 litre) inboard wing tanks and two 1,590 U.S. gallon (6,018 litre) outboard wing tanks. Oil capacity 24 U.S. gallons (91 litres).



A drawing of the Lockheed Electra Airliner (four Allison 501 turboprop engines).



A Lockheed Model 749 Constellation in the colours of the British Overseas Airways Corporation.

ACCOMMODATION.—Pressurised cabin for crew of five and passengers maintains 8,000 ft. (2,440 m.) cabin atmosphere at 30,000 ft. (9,150 m.). Internal diameter of cabin 10 ft. 8 in. (3.25 m.). Initial version for American Airlines will have accommodation for 81 passengers including 6 in a special "continental sky lounge"; but a high-density version with seats for 85 passengers and a 6-seat lounge will also be available. In international configuration, seating can be 44 (siesta arrangement), 65 (mixed custom and standard), 66 (custom) or 88 (standard). The international version will have four toilets instead of the normal two. Integral passenger loading steps will fold into the fuselage wall when not in use. Main cabin floor area 707 sq. ft. (65.68 m.²). Main cabin luggage space 119 cub. ft. (3.37 m.³). Lower compartment cargo space 511 cub. ft. (14.47 m.³). All versions will carry up to 4,000 lb. (1,816 kg.) of air freight, express and mail, in addition to the normal amount of passengers' baggage.

EQUIPMENT.—Standard equipment will include autopilot and weather-avoidance radar.

DIMENSIONS.—
Span 99 ft. (30.18 m.).
Length 104 ft. 6½ in. (31.81 m.).
Height 32 ft. 1 in. (9.78 m.).

WEIGHTS.—
Weight empty (domestic) 56,000 lb. (25,401 kg.).
Weight empty (international) 57,000 lb. (25,855 kg.).
Normal payload 21,638 lb. (9,815 kg.).
Max. weight limit payload 26,500 lb. (12,020 kg.).
Gross T.O. weight 113,000 lb. (51,256 kg.).
Max. landing weight 95,650 lb. (43,385 kg.).
Max. zero fuel weight 86,000 lb. (39,010 kg).

PERFORMANCE.—
Max. speed at 12,000 ft. (3,660 m.) 448 m.p.h. (722 km.h.).
Cruising speed at 85,500 lb. (38,782 kg.) A.U.W. at 22,000 ft. (6,700 m.) 405 m.p.h. (652 km.h.).
Stalling speed at 95,650 lb. (43,385 kg.), flaps down, 107 m.p.h. (172 km.h.).
Max. rate of climb at S/L. at 113,000 lb. (51,256 kg.) A.U.W. 1,670 ft./min. (509 m./min.).
Max. rate of climb at S/L. at 92,000 lb. (41,731 kg.) A.U.W. 2,400 ft./min. (731 m./min.).
Service ceiling at 100,000 lb. (45,359 kg.) A.U.W. 27,000 ft. (8,230 m.).
CAA take-off runway at 113,000 lb. (51,256 kg.) A.U.W. 5,820 ft. (1,775 m.).
CAA take-off runway at 106,700 lb. (48,217 kg.) A.U.W. 5,250 ft. (1,600 m.).
CAA landing runway at 85,500 lb. (38,782 kg.) A.U.W. 4,960 ft. (1,510 m.).
Range at take-off weight of 113,000 lb. (51,256 kg.), with 18,000 lb. (8,165 kg.) payload and 7,100 lb. (3,220 kg.) fuel reserve 2,770 miles (4,458 km.).

THE LOCKHEED CONSTELLATION.
U.S. Air Force designation: C-121.
U.S. Navy designation: WV.

The design of the original Model 49 Constellation was begun in June, 1939, to the requirements of Transcontinental & Western Air, Inc. During its development, and after consultation with T.W.A., Pan American Airways also ordered a number of Constellations but on the entry of the United States into the war both companies waived their rights in favour of the Army Air Forces, to whose requirements the Constellation was completed. The first Constellation to fly on January 9, 1943, was a C-69 military transport. The first Constellation to be built throughout as a commercial aeroplane was completed in 1947.

The following are the various currently-used versions of the civil and military Constellations :—

Model 49. First commercial version. Built from components of C-69 military Constellations cancelled on VJ-Day and modified for civil airline use. ATC No. 763 granted by C.A.B. on December 11, 1945. Gross take-off weight 96,000 lb. (43,585 kg.). Landing weight 83,000 lb. (37,680 kg.). Total fuel capacity 4,690 U.S. gallons (17,130 litres).

Model 149. This was the Model 49 with the outer wings of the Model 749. Total fuel capacity 5,820 U.S. gallons (22,000 litres). Gross take-off weight 100,000 lb. (45,400 kg.).

Model 649A. First Constellation built throughout as a commercial type. Four Wright Cyclone 749C18BD1 engines, direct fuel-injection. Total fuel capacity 4,690 U.S. gallons (17,130 litres). More luxuriously furnished and has slightly greater maximum and cruising speeds. Gross take-off weight increased to 98,000 lb. (44,490 kg.). Landing weight 89,500 lb. (40,630 kg.). The Speedpak was first used in this model.

Model 749. Long-range version of the 649. Additional fuel tank (565 U.S. gallons=2,135 litres) in each outer wing, to raise total fuel capacity to 5,820 U.S. gallons (22,000 litres). Range increased by 1,000 miles (1,600 km.) while carrying the same payload as the 649. Gross take-off weight 102,000 lb. (46,310 kg.). Landing weight 84,500 lb. (38,363 kg.).

Model 749A. Max. take-off weight 107,000 lb. (48,580 kg.), permitting use of Speedpak at any load factors up to range of 2,200 miles (4,520 km.). Fuel capacity 5,820 U.S. gallons (22,000 litres).



A Lockheed Model 1049C Super Constellation of Pakistan International Airlines.



The Lockheed Model 1049G Super Constellation here seen fitted with a radar nose.

Maximum landing weight 89,500 lb. (40,633 kg.).

C-121A. Military long-range personnel and cargo version of the Model 749.

VC-121B. Military long-range V.V.I.P. transport version of the Model 749.

WV-1. Modified 749 to test advanced electronic systems. Two ordered by U.S. Navy. First flew on June 9, 1949.

Full details of the structure and performance of the Constellation have appeared in earlier editions of "All the World's Aircraft."

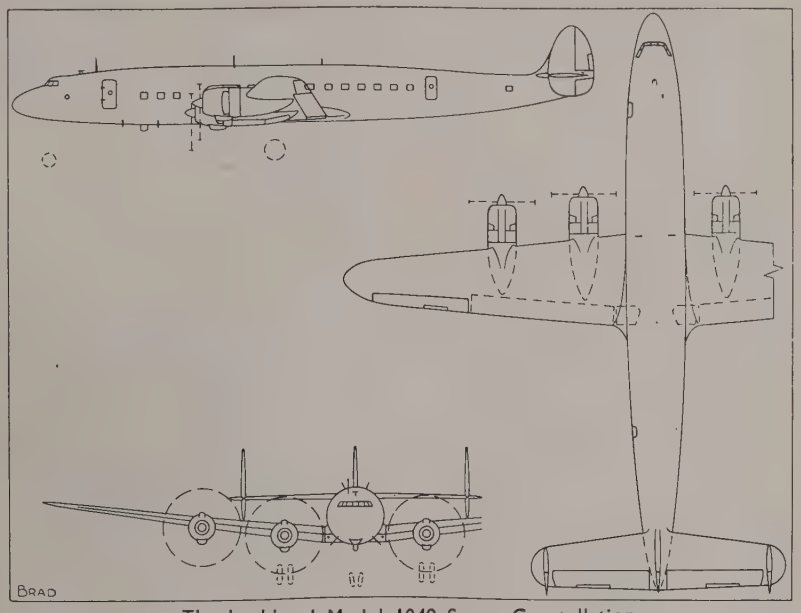
THE LOCKHEED 1049 SUPER CONSTELLATION.

U.S. Air Force designation: C-121.
U.S. Navy designations: R7V and WV.

The Super Constellation Model 1049 is basically similar to the Constellation, but with a longer fuselage and other improvements to increase its payload and performance. Details of the various currently-used and production versions, both civil and military, are given hereafter :—

Model 1049. First Super Constellation. Fuselage 18.4 ft. (5.6 m.) longer than that of Constellation. Four 2,800 h.p. Wright Cyclone 956C18 CB1 engines. Fuel capacity 6,550 U.S. gallons (24,760 litres). Gross take-off weight 120,000 lb. (54,480 kg.). Landing weight 98,500 lb. (44,720 kg.). Carries up to 92 passengers. Cruising speed 320 m.p.h. (512 km.h.). Fourteen were delivered to Eastern Air Lines and ten to Trans World Airlines in 1952. First prototype, a conversion of the original C-69 prototype, flew for the first time on October 13, 1950.

Model 1049C. This is the 1049 fitted with four Wright R-3350-DA1 Turbo Compound engines. First to incorporate Lockheed-Dreyfuss interior, the convertibility features of which make possible a 47-seat "siesta" version, a 59-63 passenger luxury version or a 94-seat tourist version. On domestic versions the compartment needed for extra crew on trans-Atlantic flights may be used for passengers so that capacities are slightly higher; up to 99 in tourist version. Gross take-off weight 133,000 lb. (60,380 kg.). Maximum landing weight 110,000 lb. (49,940 kg.). First Model 1049C flew for first time on February 17, 1953. Model 1049C Super Constellations are in service with the following airlines: Air France 9, Pakistan International 3, Qantas Empire Airways 3, Trans-Canada Air Lines 5, Air-India International 2, Eastern Air Lines 16, K.L.M. 8.



The Lockheed Model 1049 Super Constellation.

Model 1049D. Commercial cargo transport version of 1049 fitted with four 3,250 h.p. Wright R-3350-DA1 Turbo Compound engines. Has total usable cargo volume of 5,568 cub. ft. (156 m.³)



The Lockheed Model 1049H convertible passenger/cargo version of the Super Constellation.



The Lockheed C-121C Military Long-range Transport version of the 1049 Super Constellation.

and a capacity for 36,200 lb. (16,435 kg.) of payload. Two large cargo loading doors, aft door 9 ft. 4½ in. × 6 ft. 2½ in. (2.85 m. × 1.89 m.), forward door 5 ft. 1½ in. × 6 ft. 4¾ in. (1.56 m. × 1.94 m.). Maximum T.O. weight 135,400 lb. (61,416 kg.) Maximum landing weight 113,000 lb. (51,256 kg.). Four in service with Seaboard & Western Airlines.

Model 1049E. Improved version of 1049C with same maximum take-off weight but with addition of all structural modifications (except to landing gear) to permit increase of maximum take-off weight to 150,000 lb. (68,100 kg.) when engines of higher power become available. Some Model 1049E's have been modified into 1049E/01's with maximum take-off weight of 135,400 lb. (61,416 kg.), and some to 1049E/02's with this same take-off weight plus an increase in landing weight to 113,000 lb. (51,256 kg.).

In service with the following airlines: K.L.M. 4, Qantas Empire Airways 7, Air-India International 3, Avianca 3, Iberia 3, L.A.V. 1, T.C.A.2, Seaboard and Western 1

Model 1049G. Four 3,250 h.p. Wright R-3350-DA3 Turbo Compound engines. Can be fitted with wing-tip auxiliary tanks (600 U.S. gallons each) raising total maximum fuel capacity to 7,750 U.S. gallons (29,340 litres). Normal range (with reserves) 4,620 miles (7,440 km.), absolute range 5,840 miles (9,400 km.). Maximum gross take-off weight 137,500 lb. (62,425 kg.). Maximum permissible landing weight 113,000 lb. (51,300 kg.).

Model 1049G Super Constellations are in service with the following airlines:— Air France 14, Northwest Airlines 4, Trans World Airlines 28, Deutsche Lufthansa 8, VARIG (Brazil) 5, Transportes Aereos Portugueses 3, Cubana de Aviacion 2, K.L.M. 6, Avianca 1, Linea Aeropostal Venezolana 1, Qantas Empire Airways 2, Trans-Canada Air Lines 2, Air-India International 3, Eastern Air Lines 10. In addition, orders in hand include Thai Airways 3, Cubana 1, L.A.V. 1, Qantas 2, T.C.A. 2, Air-India International 2, Iberia 2.

Model 1049H. Convertible passenger-cargo version of the Model 1049G, with fuselage stressed for heavy loads and new extruded aluminium floor. Designed to carry 40,203 lb. (18,236 kg.) of cargo under 5% overload conditions with a domestic interior, and a normal payload of 35,118 lb. (15,929 kg.). The 83 ft. (25.3 m.) long main cabin and two lower compartments provide 5,569 cub. ft. (157 m.³) of stowage space. Dimensions of the rear cargo double-door are 9 ft. 4½ in. wide by 6 ft. 2½ in. high (2.85 m. × 1.88 m.) and of the forward door 5 ft. 1½ in. wide by 6 ft. 4¾ in. high (1.56 m. × 1.95 m.).

The Standard Model 1049H is so equipped that it can be converted in a few hours into a passenger aircraft with accommodation for up to 109 passengers and a crew of eleven. Quickly-installed fittings include lounge-type chairs, hat-racks, vinyl interior walls, toilets, curtains, reading lights and buffet.

Dimensions and fuel capacity are as for the Model 1049G, but the Model 1049H has Wright R-3350-EA3 engines and an increased maximum take-off weight of 140,000 lb. (63,500 kg.). Normal range with three hours of reserve fuel is 4,313 miles (6,940 km.) in passenger configuration or 3,393 miles (5,459 km.) in cargo configuration.

Model 1049H Super Constellations have been ordered by: The Flying Tiger Line 10, Qantas Empire Airways 2, Seaboard & Western Airlines 5, California Eastern 3, Resort Airlines 2, Air Finance 3, National 4, Dollar Association 1, Pakistan International 2, K.L.M. 1, REAL (Brazil) 4.

There are ten military and naval versions of the 1049 Super Constellation, brief details of which follow:—

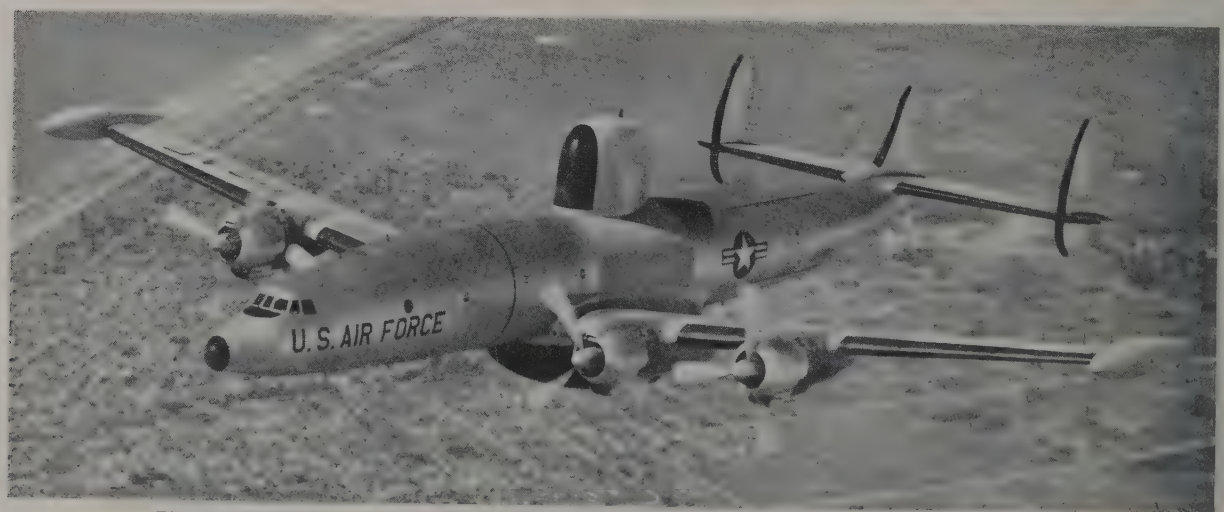
C-121C. Military long-range transport version of the Model 1049 with Wright R-3350 Turbo Compound engines. Quickly convertible to carry 75 passengers, 47 litter patients and attendants, or 14 short tons of freight. Take-off weight 135,400 lb. (61,416 kg.).

EC-121C. U.S.A.F. version of WV-2 early-warning radar and reconnaissance aircraft. Total fuel capacity 6,550 U.S. gallons. See WV-2 below.

EC-121D. Developed version of EC-121C. Additional fuel in two wing-tip tanks (600 U.S. gallons each) and one fuselage tank (1,000 U.S. gallons). Total fuel capacity 8,750 U.S. gallons, sufficient for endurance of 24 hours.

VC-121E. Specially-equipped C-121C reserved for the use of the President of the United States.

YC-121F. Four 5,700 s.h.p. Pratt & Whitney T34-P-6 turboprop engines with Hamilton Standard three-blade airscrews, 15 ft. (4.57 m.) diameter. Two ordered by U.S.A.F. Similar to Navy R7V-2. Has capacity for 106 passengers, 18 short tons of cargo or 73 stretcher cases. A.U.W. 150,000 lb. (68,100 kg.), landing weight 113,000 lb. (51,300 kg.). Fuel capacity (including tip tanks) 8,770 U.S. gallons (33,150 litres). Cruises at 440 m.p.h. (708 km.h.) and lands at 104 m.p.h. (167 km.h.). Designed range



The Lockheed EC-121D Military Reconnaissance and Early-warning Radar Intelligence Aircraft.



The Lockheed R7V-1 Naval Transport version of the Model 1049B Super Constellation.

3,000 miles (4,800 km.), with reserves, carrying 20,000 lb. (9,080 kg.) payload. Absolute range, no reserves, 4,000 miles (6,400 km.). First YC-121F made its first flight on April 5, 1955.

WV-2. After service tests of the WV-1 Constellation, the U.S. Navy ordered into production the WV-2 to serve as a high-altitude reconnaissance and early-warning radar intelligence aircraft, and five orders so far received will extend production into 1958. Developed from Super Constellation and powered by four 3,250 h.p. Wright Turbo Compound engines. Equipped with some five and a half tons of radar and electronics, including G.E. height-finding radar in upper fuselage radome 7 ft. (2.13 m.) high, and G.E. surveillance or distance-measuring radar in the huge under-fuselage radome. Five radar consoles and plotting tables permit observation of various presentations or segments of the same basic radar picture and work on a variety of search and interception problems. Auxiliary radar units provide specialised presentations. CIC (Combat Information Center) co-ordinates all search information for communication to ships, bases or other aircraft. Navigational equipment includes storm-warning radar, Loran, etc. Equipped with bunks, galley, repair shop and all facilities for long missions. Provision for a crew of up to 31, including relief pilots, radar operators, technicians and maintenance specialists.

WV-2E. This new version of the WV-2 carries a very large radar scanner in a streamlined disc-shaped housing mounted on a pylon above its fuselage.

WV-3. Weather reconnaissance version of the WV-2, with special electronic equipment. In production for the U.S. Navy.

R7V-1. U.S. Navy transport version of the Model 1049B with four Wright R-3350-34W Turbo Compound engines. Carries up to 106 passengers in backward facing 20G removable seats, up to 19 short tons of cargo, or 73 easualties on stretchers. A.U.W. 133,000 lb. (60,380 kg.). Large loading doors fore and aft of wings.

R7V-2 (formerly R7O-2). Two aircraft powered by four 5,700 s.h.p. Pratt & Whitney T34 turboprop engines for evaluation of this type of power-plant for transport aircraft. Fitted with two 600 U.S. gallon wing-tip tanks, with provision for two additional 500 U.S. gallon underwing tanks, to give a total maximum fuel capacity of 8,770 U.S. gallons (33,150 litres). First R7V-2 flew on September 1, 1954.

The R7V-2 programme was cancelled in 1957 and one of the two aircraft, on bailment to Lockheed from the U.S. Navy, has now been fitted with four Allison 501 turboprop engines for a 1,000-hour flight test programme to speed development of these engines for the Electra.

The following description applies mainly to the civil Model 1049C. The structural description applies generally to all versions of the Super Constellation.

TYPE.—Four-engined Airliner.

WINGS.—Cantilever low-wing monoplane. All-metal structure in seven main sections consisting of centre-section, two inner wings carrying engine nacelles, two outer wings and detachable tips. Two-spar structure with flush-riveted stressed metal skin. All-metal ailerons each have controllable trim-tab and hydraulic boost control. Lockheed-Fowler trailing-edge flaps extend from ailerons nearly to centre-line of fuselage. Gross wing area 1,650 sq. ft. (153.5 m.²).

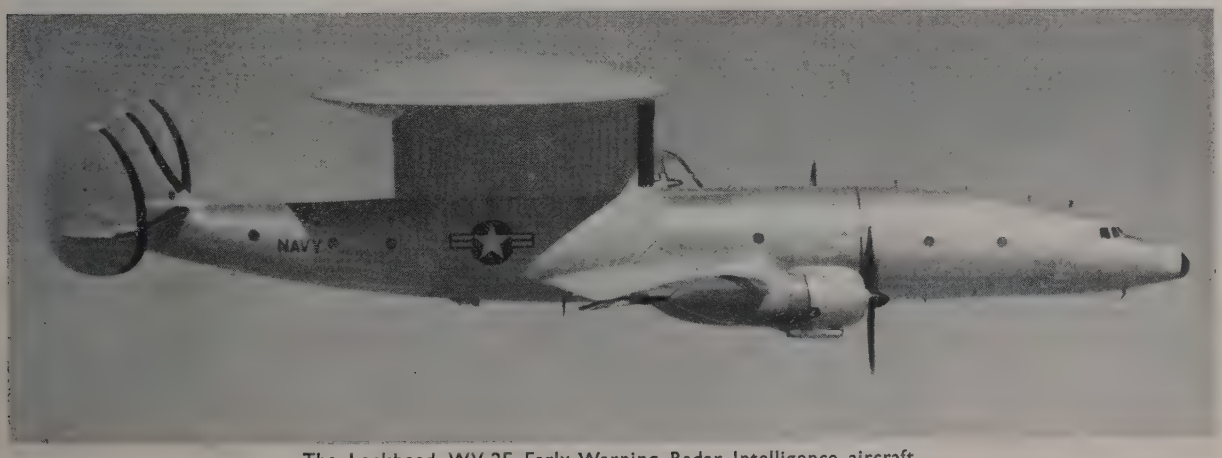
FUSELAGE. — All-metal semi-monocoque structure. Circular cross-section throughout length and with centre-line cambered for aerodynamic cleanliness.

TAIL UNIT.—Cantilever monoplane type, consisting of tailplane and two-piece elevator mounted at top of fuselage, and two inset fins and rudders with third fin and rudder on fuselage centre-line. All-metal structure with stressed metal skin on fins, tailplane and elevators. Metal-framed fabric-covered rudders. Controllable trim-tabs in rudders and elevators. Hydraulically-boosted control surfaces with manual override control for auxiliary use. Tailplane span 50 ft. 0 in. (15.24 m.).

LANDING GEAR.—Retractable tricycle type with dual wheels on all units. Dual hydraulic brake system on main wheels with manual auxiliary override control. Track (centre-line of legs) 28 ft. 0 in. (8.50 m.).

POWER PLANT.—Four Wright R-3350-DA1 Turbo Compound eighteen-cylinder two-row radial air-cooled engines each rated at 3,250 h.p. for take-off. Stainless-steel nacelles, with all ducting and controls grouped at fire-proof bulkhead, are completely detachable and can be changed in 30 minutes. Automatic fire-detection and location with positive fire-extinguisher system operated by flight engineer. Hamilton Standard or Curtiss three-blade reversible airscrews, 15 ft. 2 in. (4.62 m.) diameter. Seven separate fuel systems in wings with total capacity of 6,550 U.S. gallons (24,760 litres). Total oil capacity 227 U.S. gallons (858 litres) in five separate tanks.

ACCOMMODATION.—Pressurized cabin for crew and passengers maintains 8,000 ft. (2,440 m.) cabin atmosphere at 22,800 ft. (6,955 m.). Two fully-automatic cabin superchargers with manual override control. Thermostatically-controlled heating and cooling. Refrigeration unit cools cabin to 80 degrees Fahrenheit with outside temperature at 99 degrees Fahrenheit. Pilot's compartment in forward portion of fuselage with pilot (on port) and co-pilot side-by-side with dual controls. Flight engineer behind co-pilot facing outboard. Radio-operator behind pilot. Two cabin attendants. Entry to crew compartment on starboard side. Aft of crew compartment is a section which may be used as a galley, buffet, etc. Next follows main passenger cabin, insulated against sound, vibration and outside temperature. Many alternative arrangements allow for total accommodation up to 94 passengers. Two passenger doors and one separate crew door. Two freight compartments with total capacity of 728 cub. ft. (20.6 m.³) below floor of main cabin. Other freight stowage dependent on passenger accommodation. On some Models additional freight, etc. can be carried in an all-metal pannier, known as a "Speedpak," 33 ft. long × 7 ft. wide × 3 ft. deep (10.05 × 2.13 × 0.9 m.) and weighing 1,800 lb. (817 kg.). This is carried under and closely fits the contour of fuselage. The "Speedpak" has capacity of 400 cub. ft. (11.32 m.³) and a stowage allowance of 8,200 lb. (3,723 kg.). Built-in electric hoists lower "Speedpak" to ground for loading



The Lockheed WV-2E Early-Warning Radar Intelligence aircraft.



The Lockheed Model 1649A Starliner (four 3,400 h.p. Wright Turbo Compound engines).

or unloading. "Speedpak" reduces speed by about 12 m.p.h. (19.2 km.h.).

DIMENSIONS.—
Span 123 ft. 0 in. (37.49 m.).
Length 113 ft. 7 in. (34.65 m.).
Length with nose radome 116 ft. (35.35 m.).
Height over fuselage 18 ft. 10 in. (5.73 m.).
Height overall 24 ft. 9 in. (7.56 m.).

WEIGHTS (Model 1049E).—
Max. take-off loaded weight 133,000 lb. (60,380 kg.).
Max. landing weight 110,000 lb. (49,940 kg.).

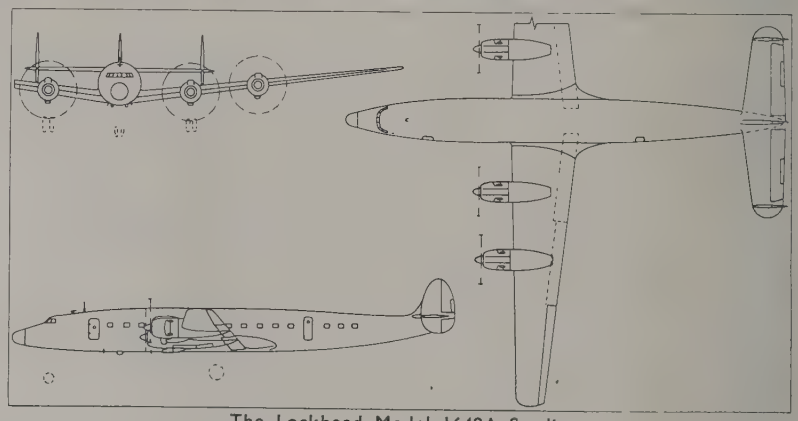
PERFORMANCE (Model 1049E).—
Max. speed (fully loaded) 352 m.p.h. (563 km.h.) at 10,500 ft. (3,200 m.).
Max. speed (at max. landing weight) 376 m.p.h. (602 km.h.) at 20,000 ft. (6,050 m.).
Max. cruising speed at 75% power, 331 m.p.h. (530 km.h.) at 23,000 ft. (7,015 m.).
Landing speed 99.5 m.p.h. (159 km.h.).
Initial rate of climb (at max. A.U.W. at S/L.) 1,140 ft./min. (348 m./min.).
Initial rate of climb (at max. A.U.W. at S/L.) one engine inoperative 640 ft./min. (195 m./min.).
Max. range (full fuel, no reserve) at 10,000 ft. (3,050 m.) 4,820 miles (7,710 km.).
Take-off distance to clear 50 ft. (15 m.) with full load, 4.600 ft. (1,403 m.).
Landing distance from 50 ft. (15 m.) at max. landing weight 3,550 ft. (1,083 m.).

THE LOCKHEED 1649A STARLINER.

The Model 1649A is an extra long-range derivative of the Super Constellation, with a completely new wing of thinner section and with an aspect ratio of 12, compared with 9.12 on the Model 049 through to Model 1049H. The entire wing, with minor exceptions, is constructed of large integrally-stiffened panels, up to 40 ft. (12.2 m.) long and measuring from $1\frac{3}{4}$ to $\frac{1}{2}$ in. (4.44 to 1.27 cm.) in thickness.

Cabin noise is reduced by improved sound- proofing, the fact that the engines are mounted five feet further from the cabin than in previous models and by using a lower propeller speed, with an 0.355 reduction compared with 0.4375 on earlier models. The main landing gear has been strengthened and redesigned so that it now retracts into the engine nacelles, eliminating structural cutouts in the wing. All controls are completely new and power-boosted by a 3,000 lb./sq. in. (211 kg./cm.^{2}) hydraulic system.

Model 1649A Starliners have been ordered by the following airlines : Trans World Airlines 24, Air France 10, Linee Aeree Italiane 4, Deutsche Lufthansa 4. The prototype flew on October 10, 1956 and later made 130 flights totalling 165 hours in a period of 51 days to qualify for its C.A.A. Certificate. Deliveries to T.W.A. began in April, 1957.



The Lockheed Model 1649A Starliner.

TYPE.—Four-engined Long-range Airliner.

WINGS.—Cantilever low-wing monoplane. NACA wing section one-sixth thinner than that of Model 1049. Aspect ratio 12. Integrally-stiffened all-metal structure. Wing area 1,850 sq. ft. (171.5 m.^{2}).

FUSELAGE AND TAIL UNIT.—Basically similar to Model 1049.

LANDING GEAR.—Redesigned retractable tricycle type.

POWER PLANT.—Four Wright 988TC18EA2 Turbo Compound engines, with 3,400 h.p. each available for take-off and a cruising power of 1,800 h.p. each at 22,600 ft. (6,888 m.). Hamilton Standard or Curtiss three-blade anti-icing, fully-feathering, reversible-pitch airscrews, diameter 16 ft. 10 in. (5.11 m.). Total fuel capacity in integral wing tanks 9,600 U.S. gallons (36,300 litres).

ACCOMMODATION.—Pressurised cabin for crew and passengers. Normal crew for over-land operation is five, with provision for a crew of 11 on long-range over-ocean flights. Normal passenger accommodation on long-range services is for 58 first-class or 80-92 tourist passengers or, on mixed-class services, 26 first-class and 45 tourist. Passenger capacities are slightly higher on domestic operations. Main cabin floor area 744 sq. ft. (69.2 m.^{2}). Lower compartment cargo space 593 cub. ft. (16.79 m.^{3}).

DIMENSIONS.—
Span 150 ft. (45.6 m.).
Length (with radar) 116 ft. 2 in. (35.4 m.).
Length (without radar) 113 ft. 7 in. (34.62 m.).
Height 23 ft. 5 in. (7.14 m.).

WEIGHTS.—
Weight empty 85,262 lb. (38,675 kg.).
Max. gross take-off weight 156,000 lb. (70,700 kg.).
Max. landing weight 123,000 lb. (55,800 kg.).
Max. zero fuel weight 116,000 lb. (52,500 kg.).

PERFORMANCE (estimated).—
Max. speed at 18,600 ft. (5,670 m.) 377 m.p.h. (607 km.h.).
Max. cruising speed at max. landing weight at 22,600 ft. (6,888 m.) 342 m.p.h. (550 km.h.).
Stalling speed at max. landing weight (flaps down) 101 m.p.h. (163 km.h.).
Rate of climb at S/L. at 156,000 lb. (70,700 kg.) A.U.W. 1,080 ft./min. (330 m./min.).
Service ceiling at 156,000 lb. (70,700 kg.) A.U.W. 23,700 ft. (7,225 m.).
Take-off distance to clear 50 ft. (15.25 m.) at 156,000 lb. (70,700 kg.) A.U.W. 5,700 ft. (1,737 m.).
Landing distance at max. landing weight 3,600 ft. (1,100 m.).
Max. range, no reserves, at 15,000 ft. (4,570 m.) 7,200 miles (11,585 km.).

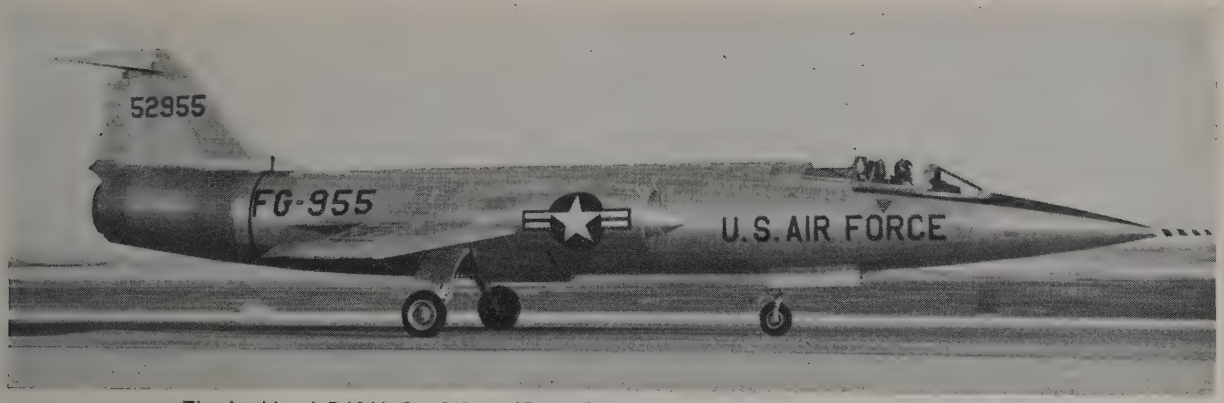
THE LOCKHEED STARFIGHTER.

U.S.A.F. designation: F-104.

The Starfighter is a supersonic "air superiority" fighter which is claimed to be the World's fastest combat aircraft. It is in quantity production for the U.S.A.F. at both the California and Georgia Divisions of the company.

Although no performance figures have been released, the F-104A version has been credited with a maximum speed in the region of Mach 2.2 to 2.3 in both level and climbing flight. Development of the design began in 1951 and versions so far announced are :—

XF-104. Two prototypes were built under this designation, with Wright J65 turbojet engine and afterburner. First flight of first XF-104 February 28, 1954.



The Lockheed F-104A Starfighter (General Electric J79 turbojet engine and afterburner).

F-104A. General Electric J79 turbojet engine. Single-seat interceptor and tactical support aircraft. In quantity production. The first production F-104A flew for the first time on February 17, 1956.

RF-104A. Projected photographic reconnaissance version of F-104A.

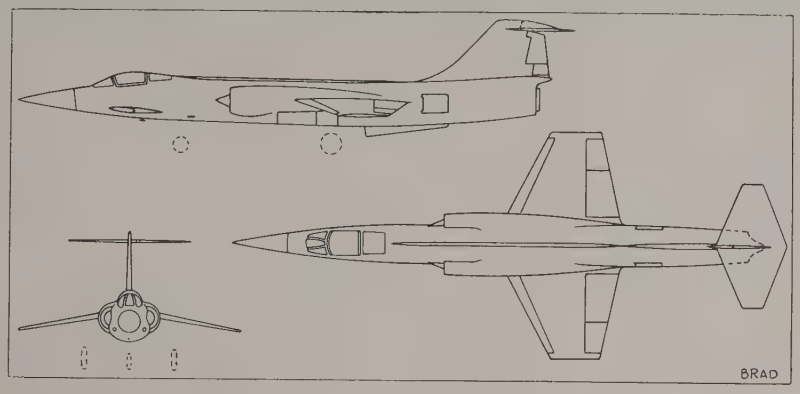
F-104B. Tandem two-seat development of the F-104A, for use as both combat aircraft and operational trainer. Prototype flew on February 7, 1957. In quantity production.

Details given below refer specifically to the single-seat F-104A version, but apply generally to all versions of the F-104.

The F-104A has a simplified structure, giving an empty airframe weight only about half that of other fighters in the U.S.A.F.'s "Century" series. This is claimed to speed production and reduce airframe costs to half those for comparable aircraft, without reduction in armament capabilities or range. In fact, the F-104A has been stated to carry more fuel than the Lockheed P-38 Lightning fighter of World War II and to have a greater range than many much larger fighters.

TYPE.—Single-seat Supersonic Fighter.

WINGS.—Mid-wing cantilever monoplane. Symmetrical supersonic wing section with a thickness/chord ratio of 3.5%. Aspect ratio 2.97. Leading-edge nose radius of 0.016 in. and razor-sharp trailing-edge. All metal structure. Each half wing measures 7 ft. 6 in. (2.29 m.) from root to tip and is a separate structure cantilevered from bulkhead strongpoint on the fuselage median line. Wings have a 10° negative dihedral. Full-span drooping leading-edge. Entire trailing-edge hinged, with inboard sections serving as landing flaps and outboard sections as ailerons. Hydraulic flap and aileron operation. Net wing area 120 sq. ft. (11.15 m.²).



The Lockheed F-104A Starfighter.

FUSELAGE.—All-metal monocoque structure.

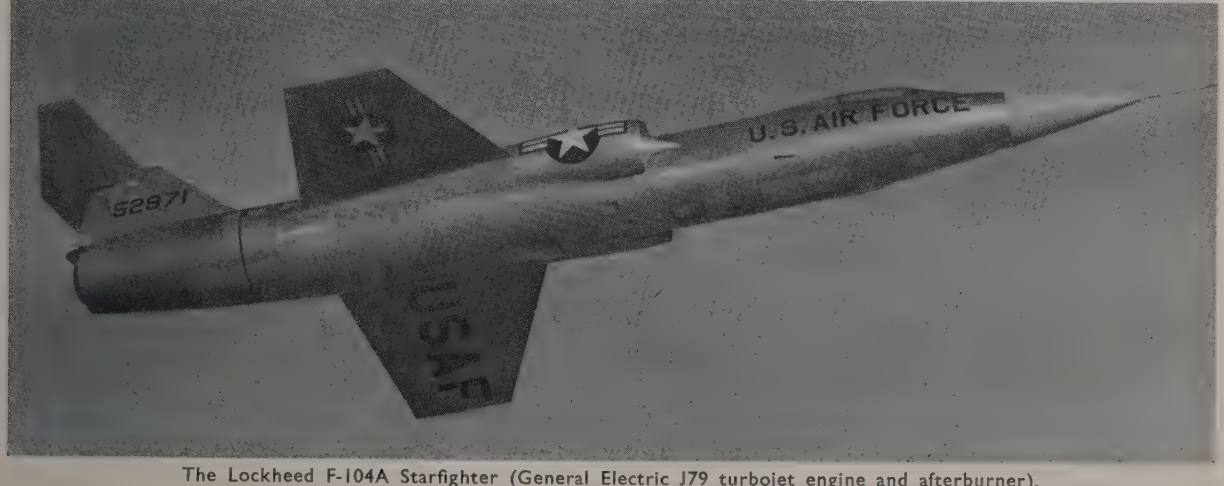
TAIL UNIT.—T-type cantilever monoplane unit with "all-flying" one-piece tail hinged at mid-chord point at top of the sweptback vertical fin. Tailplane has similar profile to wing and is all-metal. Vertical tail area approximately 40 sq. ft. (3.72 m.²). Horizontal tail area approximately 45.5 sq. ft. (4.22 m.²). Tailplane span 11 ft. 11 in. (3.63 m.).

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Main wheels raised in and forward. Steerable nose-wheel retracts forward into fuselage. Main wheel legs are hinged on oblique axes so that the wheels lie flush within the fuselage skin when retracted. Anti-skid multi-disc brakes on main wheels. Drag parachute stowed in lower part of fuselage near end of tailpipe. Wheel track 8 ft. 9 in. (2.67 m.). Wheelbase 15 ft. 1 in. (4.60 m.).

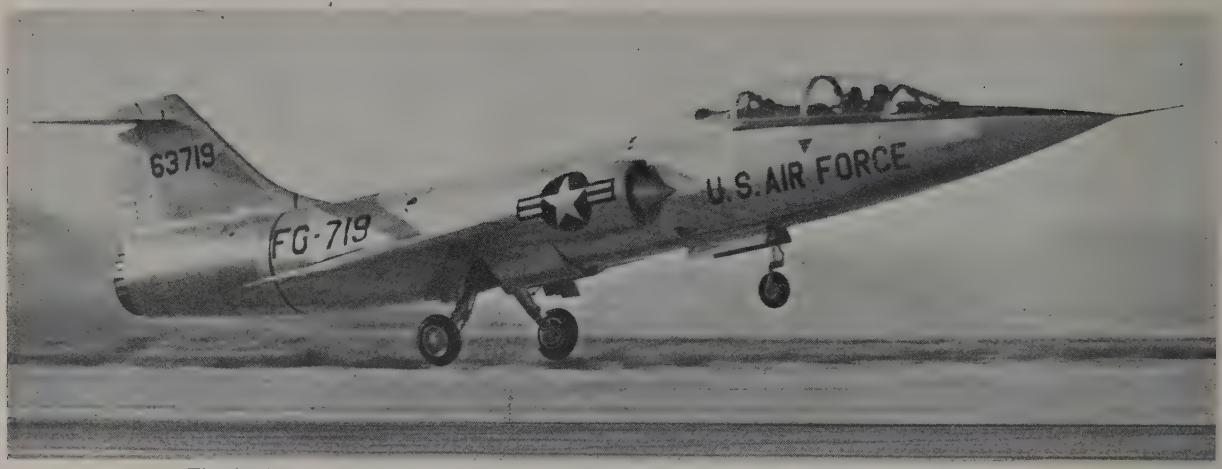
POWER PLANT.—One General Electric J79-GE-3 axial-flow turbojet engine with afterburner, rated at approximately 11,000 lb. (4,990 kg.) s.t. dry and over 16,000 lb. (7,260 kg.) with afterburning. Most of the aircraft's hydraulic equipment mounted inside large engine access door under fuselage to facilitate servicing. Internal fuel in fuselage. Jettisonable tip-tanks, each with 200 U.S. gallons (755 litres), fit over wing-tips. Provision for auxiliary under-wing pylon tanks.

ACCOMMODATION.—Pressurised and air-conditioned cockpit well forward of wings. Automatic downward pilot ejection system operates in the following sequence after release handle is pulled: (*a*) cockpit is depressurised and control column moved forward out of way; (*b*) parachute shoulder harness is tightened, pilot's legs are pulled close together and ankle clamps secure feet in place; (*c*) an explosive cartridge releases escape hatch and jettisons seat downwards and outwards; (*d*) pilot's seat belt unsnaps, freeing him from seat, and at a pre-set altitude parachute opens.

ARMAMENT.—20 mm. T-171 Vulcan six-barrel cannon developed by General Electric, in port underside of nose, and an unspecified number of Philco AAM-N-7 Sidewinder missiles. Provision for under-wing stores for ground attack or tactical support missions.



The Lockheed F-104A Starfighter (General Electric J79 turbojet engine and afterburner).



The Lockheed F-104B Starfighter Two-seat Fighter or Operational Proficiency Trainer.

EQUIPMENT.—Integrated electronics system in which various communications and navigation components may be installed as a series of interconnecting but self-sustaining units which may be varied to provide for different specific missions.

DIMENSIONS.—
Span (without tip-tanks) 21 ft. 11 in. (6.68 m.).
Length 54 ft. 9 in. (16.61 m.).
Height 13 ft. 6 in. (4.11 m.).

WEIGHTS.—
Normal take-off weight, internal fuel only, 17,000 lb. (7,710 kg.).
Normal take-off weight with tip-tanks 19,200 lb. (8,709 kg.).
Max. take-off weight with tip-tanks and under-wing tanks 22,000 lb. (9,980 kg.).
Landing weight 11,500 lb. (5,215 kg.).

PERFORMANCE.—
Max. speed approx. Mach 2.2 to 2.3 at 35,000 ft. (10,670 m.).
Approach speed 200 m.p.h. (322 km.h.).
Landing speed 164 m.p.h. (264 km.h.).
Max. range for ferrying 2,200 miles (3,540 km.).

THE LOCKHEED U-2.

The Lockheed U-2 is a research aircraft, of which a small number are being used by the NACA for high-altitude meteorological research in the United States and Europe and others by the U.S.A.F.'s 4,028th Strategic Reconnaissance Squadron in Texas. A requirement of its design was that it should be able to maintain flight at altitudes above 50,000 ft. (15,250 m.), and U-2's have in fact undertaken many sorties up to 55,000 ft. (16,765 m.) to gather data for the U.S.A.F.'s Air Weather Service.

An unusual feature is that the small underwing balancer wheels made necessary by the tandem landing gear are jettisoned after take-off, so that after landing the aircraft tips on to one of its turned-down wingtips.

Among specific data sought by use of the U-2 are more precise information about clear-air turbulence, convective clouds, wind shear and the jet stream. In addition, information on cosmic radiation and the concentration of certain elements in the atmosphere, including ozone and water vapour, is being gathered at the request of the U.S.A.F. To this end, the U-2 is very fully instrumented with equipment supplied by NACA and the Wright Air Development Center.

TYPE.—High-altitude Research monoplane.

WINGS.—Mid-wing cantilever monoplane with turned down tips. High aspect ratio. All metal structure.

FUSELAGE.—All metal monocoque structure. Air brakes on each side of rear fuselage.

TAIL UNIT. Cantilever monoplane type. All metal structure.

LANDING GEAR.—Retractable tandem tail-wheel type. Main and tail units each fitted with double wheels. Small jettisonable balancer wheels under wings. Braking parachute in container under rudder.

POWER PLANT.—One Pratt & Whitney J57 turbojet engine.

ACCOMMODATION. — Normal accommodation for pilot only under rearward-sliding canopy.

DIMENSIONS (approx.).—
Span 90 ft. (27.43 m.).
Length 45 ft. (13.72 m.).

PERFORMANCE.—
Limiting Mach number approx. 0.75.

THE LOCKHEED SHOOTING STAR.

U.S. Air Force designations: T-33 and RT-33.
U.S. Navy designation: TV-2.

The only version of the Shooting Star in production is the T-33A trainer, which is the standard jet trainer in service in the U.S.A.F., U.S. Navy, U.S. Marine Corps and has been supplied to the air forces of twelve M.D.A.P. nations. It has also been bought by four Latin-American powers—Cuba, Colombia, Peru and Venezuela.

Current orders for the T-33A will keep it in production into mid-1958 and will bring total deliveries of the type to nearly 5,500.

The following are the current versions of the Shooting Star :—

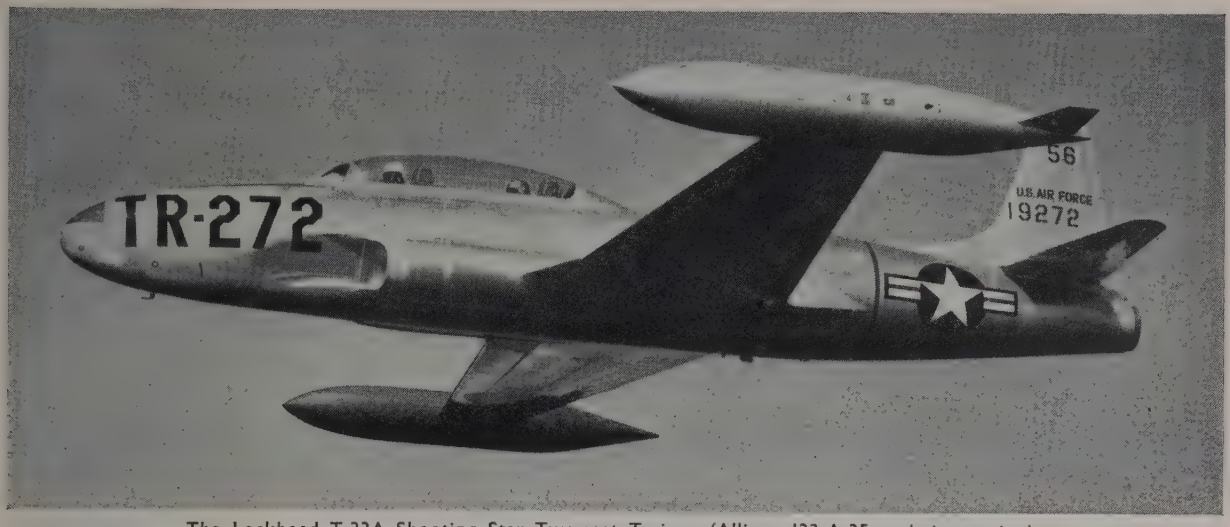
T-33A. Allison J33-A-35 engine (5,200 lb-=2,360 kg. s.t.). Fuselage lengthened by 38.6 in. (98.1 cm.), 26.6 in. forward of wings and 12 in. aft, to accommodate extra seat. Both seats under a continuous canopy hinged at rear edge and raised electrically or manually from either inside or outside aircraft. Smaller fuselage fuel tank (95 U.S. gallons=360 litres) and larger wing tanks, which are nylon cells instead of self-sealing type. Instructor in rear seat. Originally, all T-33A's had a fixed armament of two .50 in. machine-guns in their nose. New production T-33's ordered in 1955 have all-weather "navigational noses" instead of guns and many of those already in service are being modified. The new equipment includes the first combined radio compass sense antenna and VOR device, and is dual-operated with controls in both cockpits.

The T-33 is built under licence by Canadair, Ltd. Canadian production aircraft are powered by Rolls-Royce Nene engines.

RT-33A. Single-seat photographic reconnaissance version of the T-33. Carries a battery of four mapping and charting cameras and a wire recorder, to enable the pilot to make a record of the flight over the target, to elaborate on particular



The Lockheed U-2 Single-seat Research Aircraft (Pratt & Whitney J57 turbojet engine).



The Lockheed T-33A Shooting Star Two-seat Trainer (Allison J33-A-35 turbojet engine).

features of the terrain and to record height and position. Operational range of the RT-33 is said to be approximately 20 per cent. greater than that of the standard two-seat T-33.

TV-2. U.S. Navy version of the T-33A two-seat trainer.

A full structural description of the Shooting Star has appeared in previous editions of "All the World's Aircraft."

DIMENSIONS (T-33A).—
Span 38 ft. 10½ in. (11.85 m.).
Length 37 ft. 8 in. (11.48 m.).
Height 11 ft. 8 in. (3.55 m.).

WEIGHTS (T-33A).—
Weight empty 8,400 lb. (3,810 kg.).
Weight loaded 11,965 lb. (5,432 kg.).

PERFORMANCE (T-33A).—
Max. speed at S/L. 600 m.p.h. (960 km.h.).
Max. speed at 25,000 ft. (7,620 m.) 543 m.p.h. (874 km.h.).
Stalling speed (with flaps) 102 m.p.h. (164 km.h.).
Stalling speed (without flaps) 113 m.p.h. (182 km.h.).
Climb to 25,000 ft. (7,620 m.) 6.5 min.
Service ceiling 47,500 ft. (14,480 m.).
T.O. distance to 50 ft. (15.25 m.) (with water injection) 2,560 ft. (780 m.).
Landing distance from 50 ft. (15.25 m.) 3,480 ft. (1,061 m.).
Endurance 3.12 hours.

THE LOCKHEED SEASTAR.

U.S. Navy designation: T2V-1.

The SeaStar, developed from the T-33 as a "private venture" two-seat all-purpose jet trainer, has been adopted by the U.S. Navy in modified form as a "sea duty" trainer. The SeaStar, or T2V-1, is the first U.S. aeroplane to be ordered into production with boundary-layer control as standard equipment, and is the first operational jet trainer designed to perform pilot training operations in sea-going carriers as well as from land bases.

A large new order announced in November, 1956 will extend production into 1958.

TYPE.—Two-seat Naval Jet Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal structure similar to that of T-33 Shooting Star but fitted with movable leading-edge slats and boundary-layer control. Compressed air tapped from engine is ducted in tubes along trailing-edges and blown at high speed through slots in tubes over upper surfaces of flaps to increase lift and delay approach to stall.

FUSELAGE.— Light-alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure similar to that of T-33 but tailplane raised 20 in. (50.8 cm.) to position on fin, the span increased by 12 in. (30.5 cm.) and dorsal fin extension added.

LANDING GEAR.—Retractable nose-wheel type. Similar in general to that of T-33 but strengthened to absorb four times more energy on landings and take-offs. Nose-wheel strut can be hydraulically lengthened when in extended position to raise nose of aircraft for faster climbs on carrier catapult take-offs. Arrester hook under fuselage is extended hydraulically and maintained in position pneumatically.

POWER PLANT.—One Allison J33-A-22 turbojet engine (6,100 lb.=2,770 kg. s.t.) in production T2V-1. Alternatively Pratt & Whitney J48-P-8 (7,250 lb.=3,415 kg. s.t.) may be fitted. Fuel in fuselage tank (300 U.S. gallons=1,134 litres) and two non-jettisonable wing-tip tanks (230 U.S. gallons =870 litres each). Wing-tip fuel can be dumped in flight by ram air. Total fuel capacity 760 U.S. gallons (2,874 litres).

ACCOMMODATION.—Tandem seats with dual controls under jettisonable one-piece clam-shell type canopy. Rear (instructor's) seat 6 in. (15.2 cm.) higher than front seat. Ejector seats. Auxiliary inside windscreen of laminated aluminium in rear cockpit is raised automatically for wind-blast protection when canopy is jettisoned.

EQUIPMENT.—Navigational equipment includes radio and ADF installation, glide path receiver and VOR localizer, and BIA attitude gyro, a combination homing device and gyro compass. Two-in-one instruments on control panel which, by use of selector switches, give individual readings from two devices on one dial.

DIMENSIONS.—
Span (over tip-tanks) 42 ft. (12.8 m.).
Length 38 ft. (11.6 m.).
Height 13 ft. (3.9 m.).

WEIGHT LOADED.—
Approx. 16,400 lb. (7,445 kg.).

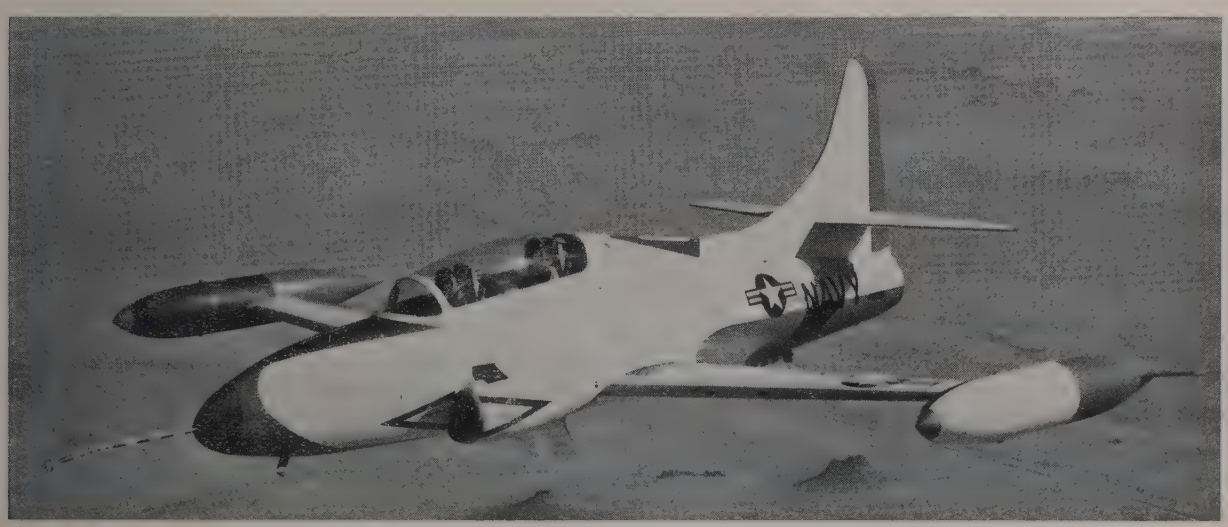
PERFORMANCE.—
Max. speed in 600 m.p.h. (960 km.h.) class.
Landing speed 97 m.p.h. (155 km.h.).
Range about 900 miles (1,440 km.).

THE LOCKHEED NEPTUNE.

U.S. Navy designation : P2V.

The first U.S. Navy contract for the Neptune was placed in April, 1944, for two XP2V-1's. Since then Lockheed has received one contract for the P2V-1, two for the P2V-2, two for the P2V-3, one for the P2V-4, ten for the P2V-5, three for the P2V-6 and five for the P2V-7. The current P2V-7 contract will extend production into mid-1959.

In addition a contract was received in October, 1954, for the conversion of all



The production Lockheed T2V-1 SeaStar Naval Trainer (Allison J33-A-22 turbojet engine).



The Lockheed P2V-7 Neptune (two 3,500 h.p. Wright R-3350 Turbo Compound engines and two Westinghouse J34 turbojets).

P2V-5's and P2V-6's to P2V-7 standard with auxiliary jet power. This modification programme will require three years to complete.

In addition to world-wide service with the U.S. Navy, the Neptune has also been supplied to the Royal Air Force, the Royal Australian Air Force, the Royal Canadian Air Force, the Royal Netherlands Air Force, the French Navy and the Japanese Maritime Self-Defence Force.

The principal versions of the Neptune are :—

P2V-1. Two Wright R-3350-8 engines each with normal rated power of 2,100 h.p. and with 2,300 h.p. for take-off, driving Hamilton Standard four-blade airscrews with alcohol de-icing. Short nose with armament of two flexible .5-in. (12.7 mm.) machine-guns. Dorsal and tail turrets each armed with two .5-in. (12.7 mm.) guns.

Between September 29 and October 1, 1946, the third production P2V-1, suitably modified, set up a World's Record for Distance in a Straight Line by flying non-stop from Perth, Western Australia, to Columbus, Ohio, U.S.A., a distance of 11,235 miles (17,976 km.). Flight time was 55 hours 17 min.

P2V-2. Two Wright R-3350-24W engines, each with take-off output of 2,500 h.p. (dry) or 2,800 h.p. (wet) and normal continuous rating of 2,100 h.p. Hamilton Standard three-blade airscrews with paddle blades and electric de-icing. Combustion type heaters for wing and tail de-icing. Longer nose ($2\frac{1}{2}$ ft.=0.76 m. longer than P2V-1) with additional search and tactical radar equipment. Nose armament increased to six 20 mm. cannon, fired by pilot. Dorsal turret armed with two .50-in. machine-guns and tail turret with two 20 mm. cannon. Other war stores as for P2V-1.

P2V-3. Two Wright R-3350-26WA engines each with a take-off output of 2,700 h.p. (dry) or 3,090 h.p. (wet) and a normal continuous rating of 2,300 h.p. P2V-3W is a special search and early warning radar version.

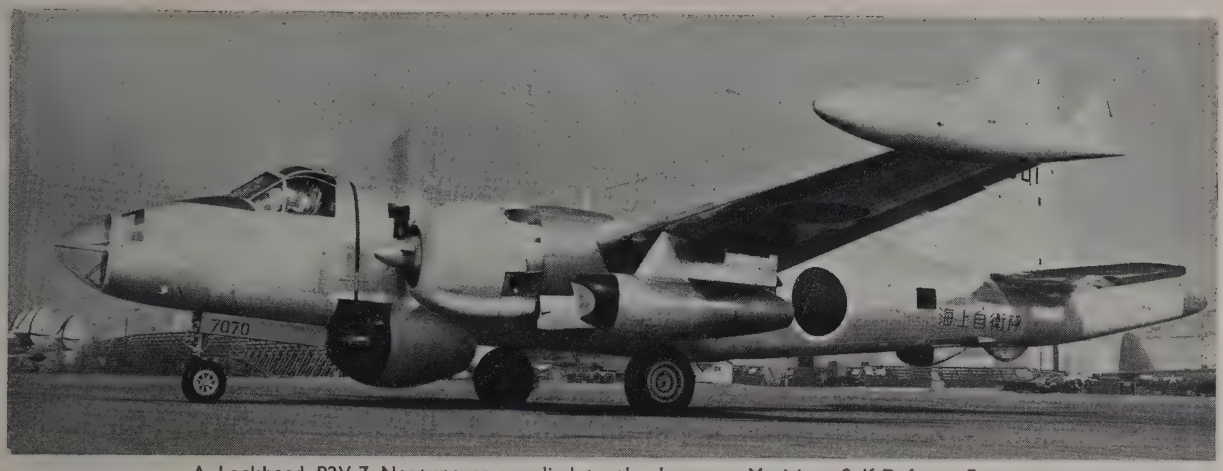
P2V-4. Two Wright R-3350-30W Turbo Compound engines each developing 3,250 h.p. for take-off (dry). This version is for long-range land-based anti-submarine and anti-surface vessel patrol and has anti-submarine detection equipment, including improved radar search apparatus with large external radome beneath fuselage, magnetic detection gear, etc. Increased wing tankage permits increased range and releases space in fuselage for additional armament and electronic devices.

P2V-5. Development of P2V-4. Has flexible nose gun turret armed with two 20 mm. cannon in place of the previous fixed nose armament. Larger wing-tip tanks carrying radar and searchlight as well as extra fuel. Considerably more internal radar and electronic equipment. First model to be fitted with elongated tail enclosing anti-submarine magnetic airborne detection (MAD) gear. All P2V-5's modified for installation of two Westinghouse J34 turbojet engines in wing-mounted pods as in P2V-7.

P2V-6. Similar to P2V-5 but specially equipped for mine-laying and anti-submarine warfare. Longer nose to give added room for forward crew and improved access to equipment, smaller wing-tip tanks and smaller radome. New features include stainless steel engine nacelles and pressure fuelling. Interchangeability for mine-laying and anti-submarine work permits a wide selection of armament. In particular, the P2V-6B is equipped to carry Fairchild Petrel air-to-surface missiles under its wings. All P2V-6's modified for installation of two



. A Lockheed P2V-7 equipped with ski gear for service with the Antarctic "Operation Deepfreeze" expeditions.



A Lockheed P2V-7 Neptune as supplied to the Japanese Maritime Self-Defence Force.

Westinghouse J34 turbojet engines in wing-mounted pods as in P2V-7.

P2V-7. Two 3,500 h.p. Wright R-3350-32W Turbo Compound engines, plus two Westinghouse J34 turbojets (3,400 lb.= 1,540 kg. s.t. each) in wing-mounted pods outboard of engine nacelles to augment take-off and combat performance. Enlarged crew space and other interior modifications of a classified nature; bulged cockpit canopy for improved all-round view; modified nose landing-gear unit; redesigned wing-tip tanks; and simplified multi-function control systems. Like all other models, the P2V-7 can be converted for patrol, mine-laying or torpedo bomber duties. The latest models have Emerson Electric turrets with two 20 mm. cannon in place of .50 in. machine-guns in mid-upper position.

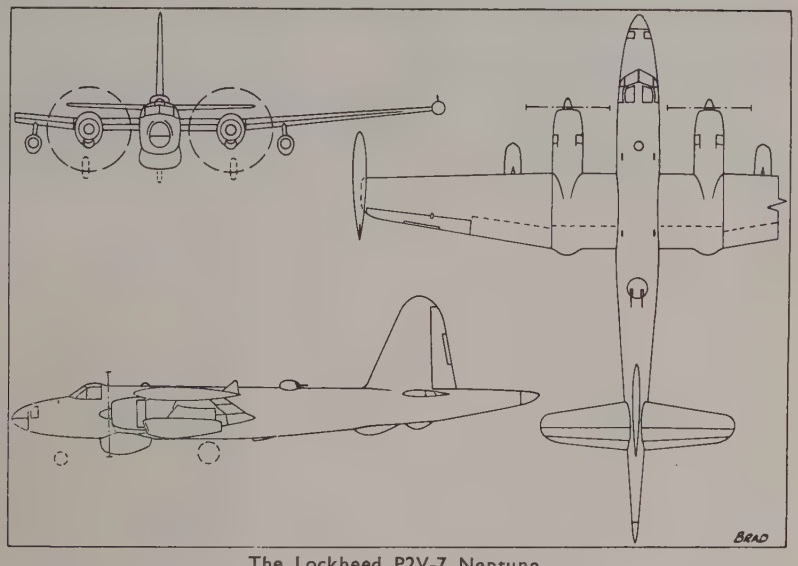
The following description applies generally to the P2V Series :—

TYPE.—Twin-engined Naval Patrol Bomber.

WINGS.—All-metal cantilever mid-wing monoplane. Aerofoil section NACA 2419 modified with max. thickness at 38% of chord. Wing designed to give temporary flotation in event of ditching. Centre-section wing box continuous through fuselage and entire bomb-bay load carried directly by wing. All-metal ailerons with controllable trim-tab in each. Lockheed-Fowler flaps on circular arc racks inboard of ailerons. Max. flap depression 32°. Ailerons also droop 10° when flaps lowered. Internal aerodynamic balances on all control surfaces. Thermal leading-edge de-icing. Gross wing area 1,000 sq. ft. (92.9 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type, with metal covering over all surfaces. Tail-unit incorporates "Varicam" (variable camber), a movable trimming surface between fixed tail and elevator which is operated by electrically-driven irreversible screw-jack. Tailplane and fin have detachable thermally-heated leading-edges. Vertical fin area 17% of wing area. Balanced control surfaces, with trim-tab in each elevator. Trim-balance tabs in rudder. Elevator area (each) 39.3 sq. ft. (3.65 m.²). Rudder area 38.4 sq. ft. (3.57 m.²).



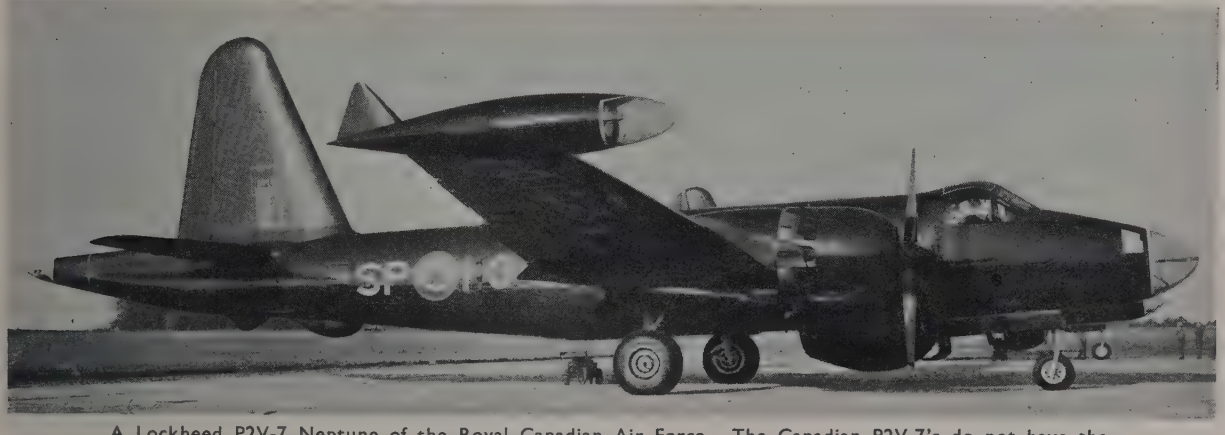
The Lockheed P2V-7 Neptune.

LANDING GEAR.—Retractable tricycle type. Hydraulic brakes on main wheels.

POWER PLANT.—Two Wright R-3350-26WA eighteen-cylinder two-row radial air-cooled engines. Hamilton Standard Hydromatic three-blade constant-speed airscrews, 15 ft. 2 in. (4.62 m.) diameter. Self-sealing fuel tanks with nylon plastic casing. Normal fuel capacity 2,200 U.S. gallons (8,316 litres). Provision for 700 U.S. gallon (2,646 litres) ferrying tank in bomb-bay. Dural armour in nacelles.

ACCOMMODATION.—Crew of seven: pilot, co-pilot, navigator/bombardier (who handles radar bombing gear), radar operator, and dorsal and rear gunners. All positions armoured. Galley and sleeping accommodation.

ARMAMENT.—Up to six 20 mm. forward-firing cannon in nose; two .5-in. (12.7 mm.) flexible machine-guns in dorsal turret (two 20 mm. cannon in latest P2V-7's); and two flexible 20 mm. cannon in power-operated tail-turret. Provision for sixteen 5-in. (12.7 cm.) rocket projectiles under wings. Bomb-load of 8,000 lb. (3,629 kg.) carried internally may consist of sixteen 500 lb. (227 kg.), eight 1,000 lb. (454 kg.) or four 2,000 lb. (907 kg.) bombs, two



A Lockheed P2V-7 Neptune of the Royal Canadian Air Force. The Canadian P2V-7's do not have the auxiliary jet pods. (*Gordon Williams*).

2,165 lb. (982 kg.) torpedoes, or 2,000 lb. (907 kg.) sea-mines, or twelve 325 lb. (147 kg.) depth-charges. MAD gear. Sonobuoy installation.

DIMENSIONS (P2V-3).—
Span 100 ft. 0 in. (30.48 m.).
Length 76 ft. 10 in. (23.43 m.).
Height (over rudder) 28 ft. 1 in. (8.5 m.).

DIMENSIONS (P2V-7).—
Span (with tip tanks) 103 ft. (31.5 m.).
Length 91 ft. 5 in. (27.9 m.).
Height 29 ft. 4 in. (8.94 m.).

WEIGHTS (P2V-3).—
Weight empty 34,683 lb. (15,746 kg.).
Disposable load 23,317 lb. (10,586 kg.).
Max. take-off weight 58,000 lb. (26,300 kg.).
Landing weight 54,000 lb. (24,520 kg.).

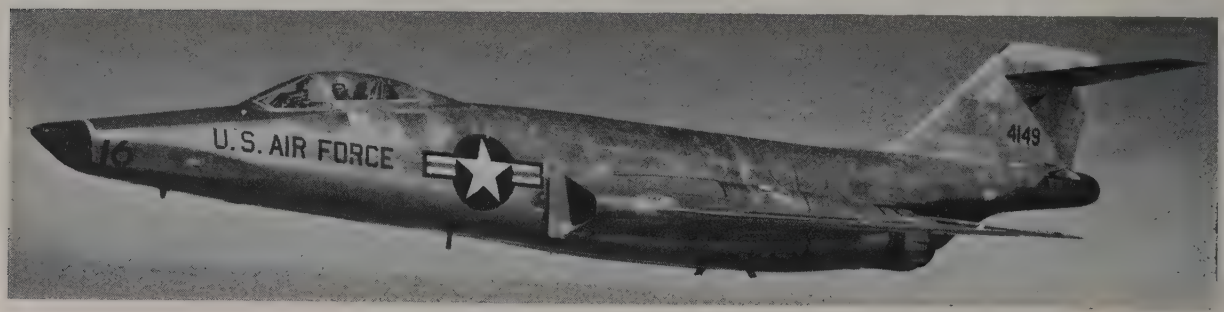
WEIGHTS (P2V-7).—
Weight empty (without auxiliary jets) 43,950 lb. (19,950 kg.).
Weight empty (with jets) 47,450 lb. (21,540 kg.).
Weight loaded (without auxiliary jets) 72,000 lb. (32,670 kg.).
Weight loaded (with jets) 75,500 lb. (34,280 kg.).

PERFORMANCE (P2V-3).—
Max. speed 300 m.p.h. (483 km.h.).
Stalling speed (power on) 77 m.p.h. (123.2 km.h.).
Initial rate of climb (T.O. weight) 2,086 ft. min. (636 m./min.).
Service ceiling 27,100 ft. (8,265 m.).
Range 3,560 miles (5,696 km.) at 180 m.p.h. (288 km.h.) at 1,500 ft. (460 m.).
T.O. distance to clear 50 ft. (15.25 m.) (T.O. weight and power) 947 yds. (866 m.).

THE LOCKHEED X-7.

Resembling a small straight-wing interceptor, the X-7 is a pilotless test vehicle for ramjet engines and missile components, with the ramjets mounted externally under the rear fuselage. It can fly at speeds well above that of sound and can be recovered at the end of each flight by an automatically-opened parachute, thereby saving about £125,000 per flight compared with the use of a non-recoverable missile.

McDONNELL



The McDonnell RF-101A Voodoo Photographic Reconnaissance Monoplane.

McDONNELL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: ST. LOUIS 3, MISSOURI.

President and Chairman of the Board: J. S. McDonnell, Jr.

Vice-President and General Manager: R. H. Charles.

Vice-President, Manufacturing: C. Warren Drake.

Vice-President, Engineering: Kendall Perkins.

Vice-President, Airplane Engineering: G. C. Covington.

Vice-President, Personnel: W. R. Orthwein, Jr.

Vice-President, Sales and Service: J. F. Aldridge.

Chief Engineer, Helicopters: Fred Doblhoff.

Chief Engineer, Missiles: B. G. Bromberg.

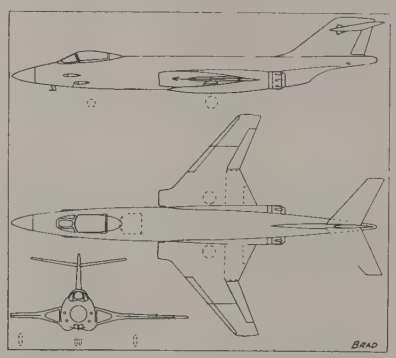
Factory Manager: W. F. Burke.

Secretary: Thomas G. Rutledge.

Treasurer: J. H. Cinnater.

The McDonnell Aircraft Corporation was incorporated on July 6, 1939. Since that date the activities of the company have been devoted exclusively to the development and production of aircraft and missiles for the U.S. Government.

The first aircraft of McDonnell design to go into production for the U.S. Navy was the FH-1 Phantom twin-jet fighter and this was followed by the F2H-1 Banshee, which went into production in 1947. The Banshee in successively developed forms was in continuous production for six years, and a total of 800 was supplied to the U.S. Navy and Marine Corps. The last F2H-4 Banshee was delivered in October, 1953. During 1955-56 the Royal Canadian Navy were receiving sixty F2H-3 Banshee all-weather fighters, this order being fulfilled by the U.S. Navy from surplus equipment.

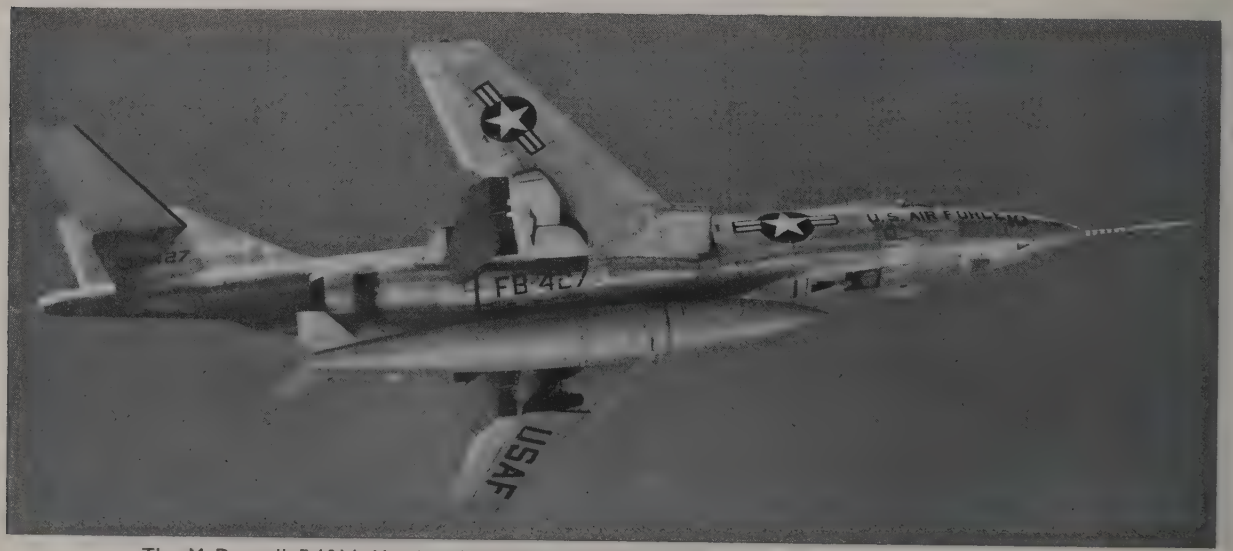


The McDonnell F-101A Voodoo.

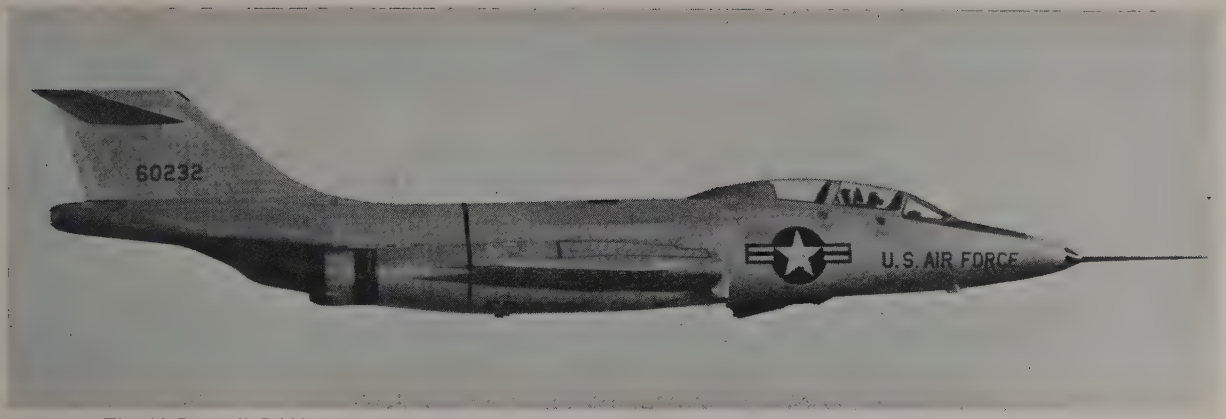
The latest U.S. Navy fighter of McDonnell design is the F3H Demon, a swept-wing carrier fighter.

For the U.S. Air Force McDonnell is building two versions of the long-range twin-jet swept-wing Voodoo, the RF-101A photographic reconnaissance fighter for the Strategic Air Command and the F-101B interceptor fighter for the Air Defense Command. Both versions of the Voodoo are supersonic in level flight.

McDonnell is also very actively engaged in rotary-wing development. In 1951 it was successful in two competitions, one for a cargo transporter or "flying crane" (XHCH-1) for the U.S. Navy, and the other for a convertiplane (XV-1) for the U.S. Army. Detailed information on the XHCH-1 as well as on the company's



The McDonnell F-101A Voodoo (two Pratt & Whitney J57 turbojet engines with afterburners).



The McDonnell F-101B Two-seat Fighter (two Pratt & Whitney J57 turbojet engines with afterburners).

work in the field of guided missiles is classified.

THE McDONNELL VOODOO.
U.S. Air Force designation: F-101 and RF-101.

The original XF-88 and XF-88A swept-wing twin-jet fighters, the latter with afterburners, underwent successful evaluation by the U.S.A.F. in 1949 and 1950, but owing to a cut-back in defense funds and a change in tactical requirements, the experimental contract was terminated in August, 1950.

After a period of over a year the XF-88A was revived and, with modifications, was ordered into production under the designation F-101A, as a long-range escort fighter for Strategic Air Command.

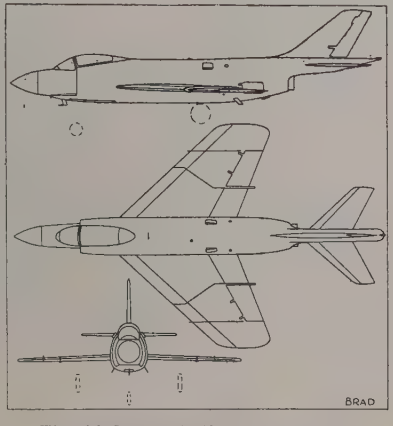
The first F-101A flew on September 29, 1954 and this aircraft exceeded Mach 1 on its first flight. Armament of the standard SAC F-101A consisted of four 20 mm. M-39 cannon, plus three Hughes GAR-1 Falcon missiles and 12 rockets. It had a rotary bomb-door on which the Falcons and other stores of various types could be carried. In-flight refuelling was fitted.

Now that the B-52 is replacing the B-36 in Strategic Air Command the need for a fighter escort aircraft has receded, and under the 1957 cut-back programme the F-101A was abandoned. All completed aircraft are scheduled to be converted to the RF-101A reconnaissance version.

Two versions of the Voodoo are still in production for the U.S.A.F. These are :—

RF-101A. Two Pratt & Whitney J57-P-13 turbojet engines (10,000 lb. = 4,540 kg. s.t. (dry) each) with afterburners. Long range photographic-reconnaissance aircraft for Strategic Air Command. Comprehensive and fully-automatic camera equipment installed in lengthened forward fuselage, but otherwise airframe, power-plant, etc. same as F-101A. First RF-101A squadron formed in April, 1957. All completed F-101A long-range escort fighters are being converted to RF-101A's.

F-101B. Long-range two-seat interceptor fighter version of F-101A intended for duty with U.S.A.F. Air Defense Command. First flown on March 27, 1957.



The McDonnell F3H-2N Demon.

Under the 1957 cut-back programme, the production programme of the F-101B was reduced and retarded.

F-101C. Developed version with strengthened airframe for low-level ground attack duties.

DIMENSIONS (F-101B).—
Span 39 ft. 8 in. (12.09 m.).
Length 67 ft. 5 in. (20.55 m.).
Height 18 ft. (5.49 m.).

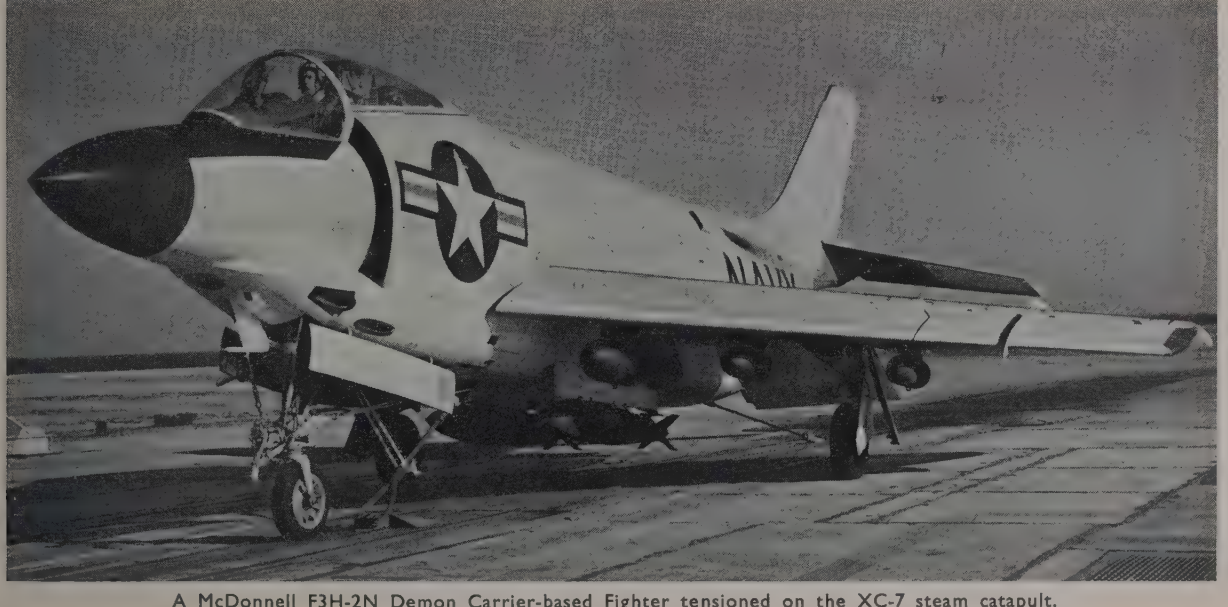
THE McDONNELL DEMON.
U.S. Navy designation: F3H.

The Demon is a single-seat single-jet swept-wing carrier-based fighter which is in production for the U.S. Navy.

The prototype XF3H-1 flew for the first time on August 7, 1951, and in August, 1952, the U.S. Navy placed an order for 150 F3H-1's, to be powered by the Westinghouse J40-W-22 turbojet engine.

During development the weight of the F3H-1 was increased from 22,000 lb. to 29,000 lb. (9,980 kg. to 13,150 kg.) to meet an all-purpose fighter requirement and a higher thrust engine, the J40-W-24, was specified in place of the original power-unit. This engine, unfortunately, did not come up to expectations, resulting in the F3H-1 being underpowered.

As a result, the last 90 of the original contract for 150 F3H-1's were re-ordered as F3H-2's with the Allison J71 engine. Of the 56 F3H-1's built, 21 early-production aircraft were retained for use as ground trainers and 29 were modified to



A McDonnell F3H-2N Demon Carrier-based Fighter tensioned on the XC-7 steam catapult.



The McDonnell F3H-2N Carrier-based Fighter. Note the retracted refuelling probe below the canopy.

take the J71 engine and converted to F3H-2 standard.

The Demon, which is of all-metal construction, has 45° sweptback thin wings and tail surfaces. The primary control system incorporates complete power actuation with separately controlled "feel" forces for the pilot. The wings have power-actuated leading-edge slats and trailing-edge slotted flaps, while speed brakes are fitted on the upper surface of each wing-root trailing-edge and on each side of the fuselage aft of the wings. The entire horizontal tailplane pivots at the fuselage to provide trim and maneouvring control throughout the entire speed range.

All combat fuel is carried in internal self-sealing tanks. Provision is also made for additional fuel in jettisonable external tanks and a retractable flight refuelling probe is carried in a fairing on the starboard side of the cockpit.

The pressurised cockpit, which is situated well forward for good forward and downward visibility, is provided with an ejection seat and jettisonable canopy.

The following are the currently known versions of the Demon :—

F3H-2N. Allison J71-A-2 turbojet engine (9,500 lb.=4,315 kg. s.t. dry) with afterburner. Night and all-weather fighter. First F3H-2 production version. Armament consists of four 20 mm. cannon and various types of external stores, including the Sidewinder Mach 2 infra-red homing missile and nuclear weapons.

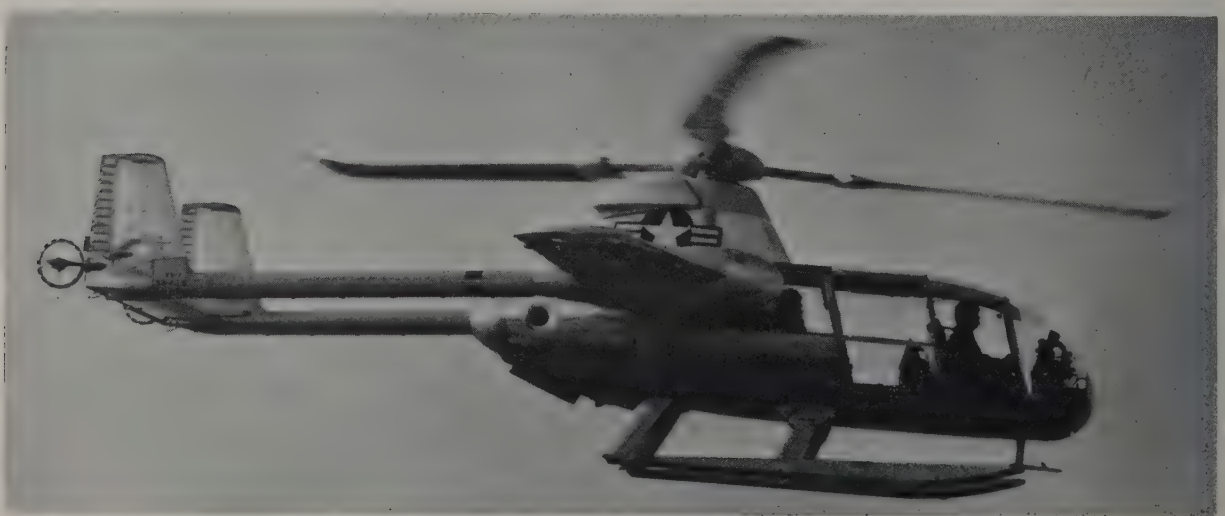


The McDonnell F3H-2M armed with four Sparrow I guided missiles.

F3H-2M. Day fighter missile carrier version armed with four 20 mm. cannon and four Sparrow I or III supersonic beam-riding missiles.

F3H-2P. Photographic reconnaissance version.

DIMENSIONS.—
Span 35 ft. 4 in. (10.7 m.).



The McDonnell XV-1 Experimental Convertiplane (550 h.p. Continental engine and McDonnell rotor-tip pressure-jets).

Length 58 ft. 11 in. (17.9 m.).
Height 14 ft. 7 in. (4.45 m.).

THE McDONNELL MODEL 82.
U.S. Air Force designation: XV-1.

The XV-1 experimental convertiplane is a joint development of the Wright Air Development Center, U.S.A.F., the Transportation Corps of the U.S. Army and the McDonnell Aircraft Corporation. It uses a jet-driven rotor for vertical flight and wings and a normally-driven propeller for forward flight, during which the rotor autorotates at its lowest drag configuration.

Each of the three blades of the rotor is powered by a McDonnell pressure-jet unit located at the blade tip. A 550 h.p. Continental R-975-19 piston engine in the rear fuselage drives two compressors to supply air to the jet units during vertical flight, and drives the 6 ft. 5 in. (1.96 m.) diameter Met-L-Prop two-blade propeller during forward flight. Fuel is fed to the rotor-tip jet burners through a rotary fuel governor which is driven from the rotor hub accessory drive. There are two small anti-torque tail rotors.

The XV-1 is designed to carry three passengers, or two stretcher patients and medical attendant, in addition to the pilot. The enclosed crew compartment is separated from the engine section by a structural firewall. Pilot and co-pilot/observer sit in tandem and are provided with removable dual controls. Exit doors may be jettisoned in an emergency.

The tail assembly consists of two vertical fins and rudders attached to the extremities of twin tail-booms. A freely-floating horizontal tail surface is mounted between the booms.

The landing-gear consists of two non-retracting skids. Landing shocks are absorbed by the yielding of replaceable stainless steel straps.

The XV-1 made its first translation from vertical to horizontal flight on April 29, 1955.

During evaluation trials in the Summer of 1956, one of the two prototypes is claimed to have set an unofficial helicopter speed record of 200 m.p.h. (322 km.h.).

Dimensions (Approx.).—
Span 26 ft. (7.93 m.).
Length 30 ft. (9.15 m.).
Height 10 ft. 8 in. (3.26 m.).

THE McDONNELL MODEL 86.
U.S. Navy designation: XHCH-1.

The XHCH-1 now being developed for the U.S. Navy is a "flying crane" or cargo transporter for short-range work, such as ship-to-shore transfer of heavy equipment, etc. It will have a power winch and retractable cargo sling to lift and carry heavy cargo and will also be able to handle cargo "pods." A prototype which is under construction will be powered by an Allison T56 shaft turbine engine. No other details are available for publication.

McKINNIE

McKINNIE AIRCRAFT COMPANY, INC.

Head Office and Works: Fargo, North Dakota.

President and Chief Engineer: James McKinnie.

Vice-President: William McKinnie.

Secretary: A. I. Johnson.

McKinnie Aircraft Co., Inc., an affiliate of Transocean Air Lines, was formed in 1947 to develop a new and simplified method of airframe design and construction.

The prototype of its first all-metal aircraft, the McKinnie 165, made its first flight on August 10, 1952, and this aircraft is now being rebuilt with a tricycle type landing gear.

McKinnie have also developed a simple modification kit for the Ryan Navion light aeroplane, consisting of wing root fairings which increase the cruising speed by 10-11 m.p.h. (16-17.7 km.h.) and give improved climb and glide characteristics. This modification has C.A.A. approval, as have the wing-tip fuel tanks for the Navion which the company has also produced.

THE McKINNIE 165.

McKinnie are re-designing their Model 165 two-seat light monoplane to have a tricycle type landing gear. A full description of the standard version, with 165 h.p. Franklin 6A4-165-B3 engine and tail-wheel landing gear, has appeared in earlier editions of "All the World's Aircraft."

MARTIN

THE MARTIN COMPANY.

Head Office and Works: Middle River, Baltimore 3, Maryland.

Other Factories: Orlando, Florida; Denver, Colorado.

Established: 1909.

Chairman of the Board and President: George M. Bunker.

Executive Vice-President: W. B. Bergen.

Vice-President, Industrial Relations: D. W. Siemon.

Vice-President, Sales and Service: Jess W. Sweetser.

Vice-President, Engineering: G. S. Trimble, Jr.

Vice-President, Finance and Controller: E. R. Uhlig.

Vice-President, Manufacturing: G. T. Willey.

Vice-President and General Manager (Orlando): E. G. Uhl.

Vice-President and General Manager (Denver): A. L. Varrieur.

President, Martin International: G. B. Shaw.

Vice-President and General Manager, RIAS, Inc.: W. W. Bender.

Secretary and Treasurer: W. L. Lucas.

Production by the Martin Company during 1956-57 was concentrated on B-57 bombers and TM-61 and TM-76 Matador tactical missiles for the U.S.A.F.; P5M-2 Marlin anti-submarine flying boats and P6M-1 attack flying boats for the U.S. Navy; Lacrosse close support missiles for the U.S. Army; and three-stage rockets for the "Project Vanguard" earth satellite programme. Brief details of Lacrosse and the Vanguard rocket are given in the "Guided Missiles" section of this book.

In addition, the company is continuing development work on Titan, an intercontinental ballistic missile of outstanding importance in the U.S. Defence programme. Initial design work on Titan was done at Baltimore, but all development and production of this missile are now concentrated at the company's new Denver works, which was completed and fully occupied late in 1956.

Other Martin activities in the missile field have included the development of Missile Master, an electronic system designed specifically for controlling and co-ordinating the operation of Nike anti-aircraft missile batteries and other advanced missiles as they become available.

During 1956, the company stated that successful test firings had been made with a new version of the Matador tactical missile, designated TM-76A. Longer than the TM-61A, this version carries a larger nose section and has an entirely new airborne guidance system. It has since been followed by the further improved TM-76B, announced in April, 1957, with more efficient guidance system and greater range.

The existence of the Lacrosse surface-to-surface missile was announced in October, 1956, when it was stated to have reached production status for the U.S. Army.

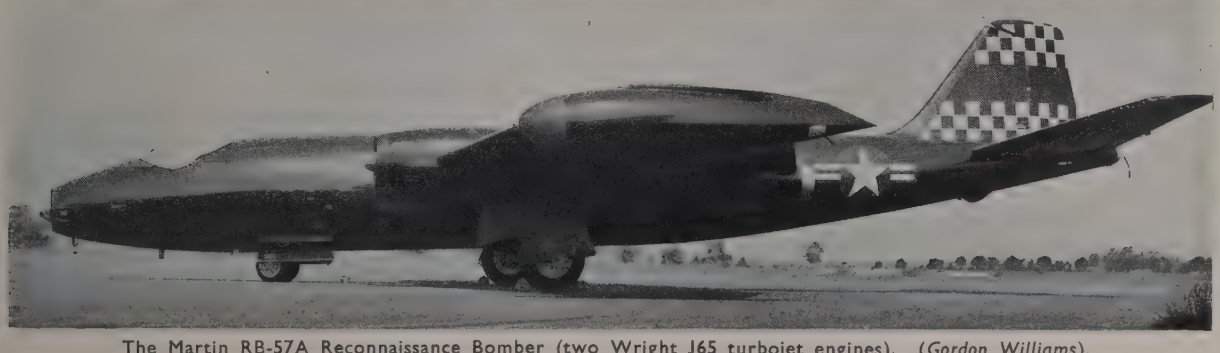
A very large site has been purchased on the outskirts of Orlando, Florida, where facilities will be equipped to meet Martin's commitments in the field of electronics, nuclear engineering and missiles, as well as piloted aircraft.

It was announced during 1956 that engineering studies were under way at Martin on a project for an airframe for a nuclear-powered flying boat. At that time, the programme had been in operation for over three years under a special contract with the Office of Naval Research and the Bureau of Aeronautics. An operations management team has since been formed to speed development of this aircraft.

Martin International will build and instal a commercial nuclear power plant in the Dominican Republic, subject to U.S. Government approval.

RIAS, Inc., the Martin subsidiary company that was formed for advanced basic research without regard to product development, moved into separate offices in Baltimore in September, 1956, with a staff of 25 scientists. Its current investigations are in the fields of metallurgy, photo-synthesis, mathematics, solid state physics and biochemistry.

During 1956, six new building projects



The Martin RB-57A Reconnaissance Bomber (two Wright J65 turbojet engines). (*Gordon Williams*).



The Martin B-57B Tactical Bomber and Night Intruder (two Wright J65 turbojet engines).

were begun or completed. Total employment was approximately 29,000.

THE MARTIN MODEL 272.
U.S.A.F. designation: B-57.

The Martin company is building under licence versions of the English Electric Canberra for the U.S.A.F. The basic American version is powered by two Wright J65 turbojet engines.

In order to convert the Canberra to fulfil its U.S.A.F. missions, as well as to adapt it to American production methods, a considerable amount of redesign was undertaken by the Martin Company.

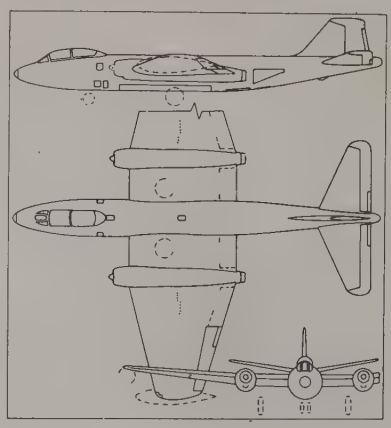
A Martin-developed feature introduced into the B-57 is a pre-loaded revolving bomb-bay door which rotates through 180 degrees just before the bombs are released, leaving no excrescences to reduce speed on the bombing run.

The following versions of the B-57 have been announced :—

B-57A. Two Wright J65-W-1 turbojet engines (7,220 lb.=3,280 kg. s.t. each). Pre-production model externally similar to the British Canberra but incorporating many internal changes. Crew of two—pilot and navigator/radar operator/bombardier. First B-57A flew for the first time on July 20, 1953.

RB-57A. Reconnaissance version of B-57A. First RB-57A delivered to U.S.A.F. in March, 1954.

B-57B. Two Wright J65-W-5 engines (7,200 lb.=3,280 kg. s.t. each). Night intruder or tactical bomber. Crew of two, pilot and radar operator/navigator/bombardier, in tandem beneath continuous jettisonable canopy. Ejector-type seats. Improved bullet-proof windscreen



The Martin B-57B.

with anti-icing and de-misting. Hydraulically-operated speed brakes added to rear fuselage. These move in co-ordination with "finger" type brakes on each wing. Armament consists of eight wing-mounted .50 in. machine-guns or four 20 mm. cannon. Four Napalm tanks in addition to eight 5-in. HVAR rockets may be carried on pylons under wings. Other stores may be carried on revolving bomb-bay door. Gross weight over 50,000 lb. (22,700 kg.). Maximum speed over 600 m.p.h. (960 km.h.), ceiling over 45,000 ft. (13,725 m.), and range more than 2,300 miles (3,700 km.). First B-57B flew for the first time on June 28, 1954.

B-57C. Basically similar to B-57B, but with dual controls so that it can perform the additional rôle of conversion training. For instrument training, for giving piston-engine pilots experience in jet operation or for giving single-engine fighter pilots multi-jet experience. The first B-57C flew on December 30, 1954.

RB-57D. High-altitude version, in use as a flying test bed for two 10,000 lb. (4,536 kg.) s.t. Pratt & Whitney J57 turbojet engines.

B-57E. Basically similar to B-57B but for dual service as tactical bomber and high-speed target tug. Capable of towing a wide variety of targets, four of which are normally carried in external containers on each flight. Conversion to bomber involves simply removal of the cockpit towing controls, external target containers and the internal cable reels and fittings which are normally carried on the rotary bomb-door. Intended to provide both air-to-air and ground-to-air firing practice at high altitudes.

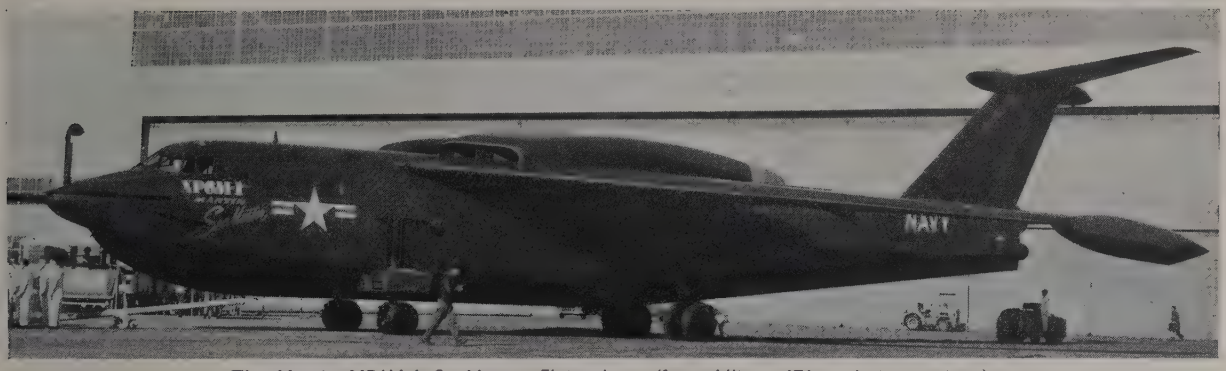
DIMENSIONS.—
Span 64 ft. (19.5 m.).
Length 65 ft. 6 in. (19.9 m.).
Height 16 ft. (4.88 m.).

THE MARTIN MODEL 275 SEAMASTER.
U.S. Navy designation: P6M.

The SeaMaster is a four-jet swept-wing high-performance flying-boat of advanced design. Its two primary functions will be mine-laying and photographic reconnaissance but it will also be able to undertake other combat tasks, and remain in operation—in the air or afloat—for long periods of time. Beaching-gear and other facilities permitting automatic pick-up of moorings can be carried, while air-transportable dry dock and servicing dock facilities are being built by Martin under a separate Navy contract.



Two Martin B-57E High-speed Target Tugs, one with a target streamed.



The Martin XP6M-1 SeaMaster Flying-boat (four Allison J71 turbojet engines).

The following versions have been announced :—

XP6M-1. Two prototypes, first flown July 14, 1955 and May 18, 1956 respectively. Both lost in flying accidents attributed to faults in the tail and tail-plane-actuating mechanism.

YP6M-1. Six pre-production aircraft, powered like the prototypes with four Allison J71 turbojets. Production schedule stretched while new empennage is designed for these. First YP6M-1 expected to fly in Autumn of 1957.

P6M-2. An order for 24 of this version, with more powerful Pratt & Whitney J75 turbojets, was placed in August, 1956, but was reduced to 18 aircraft in 1957.

The following details refer specifically to the XP6M-1, but are expected to be generally applicable to later versions.

TYPE.—Four-jet multi-rôle Military flying boat.

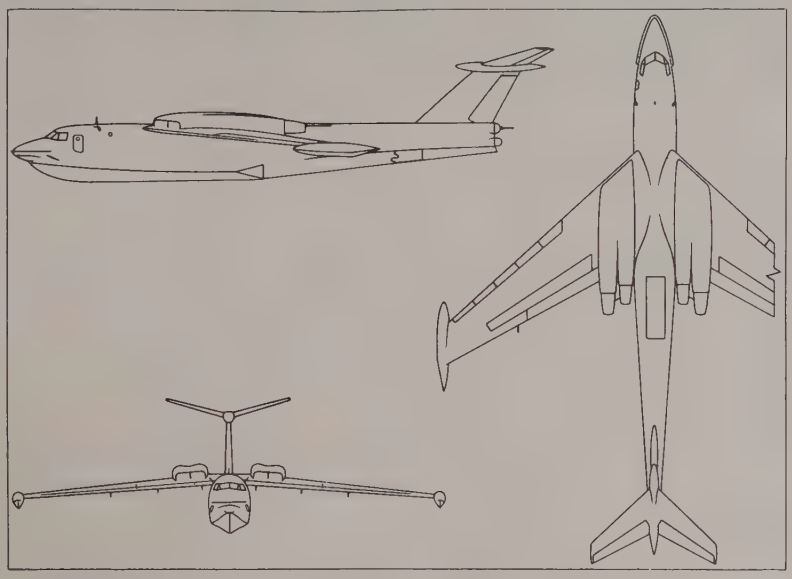
WINGS.—Cantilever high-wing monoplane. Combination of sharp sweep-back and anhedral brings wing-tips so close to the water when the aircraft is at rest that the floats can be fixed permanently to the wing-tips. Gross wing area 1,900 sq. ft. (176.5 m.²).

HULL.—All-metal semi-monocoque structure of high length/beam ratio. Single faired Vee-step. Martin-developed hydroflaps on both sides of the afterbody serve as water rudders when opened individually or as water brake when extended together. Maximum beam 10 ft. (3.05 m.).

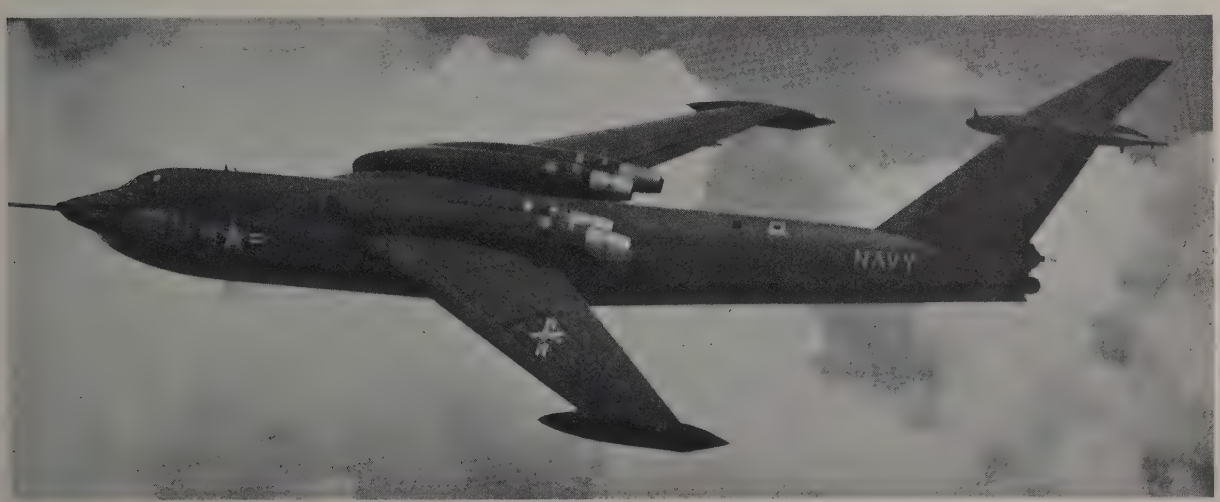
TAIL UNIT.—Cantilever monoplane structure, with tailplane mounted at the tip of the fin. All units sharply swept-back. Total area fin and rudder 213 sq. ft. (19.79 m.²).

POWER PLANT.—Four Allison J71 turbojet engines with afterburners (XP6M-1) or four Pratt & Whitney J75 turbojets (production aircraft). The engines are mounted in pairs in nacelles on the upper wing surfaces. The upper portions of the nacelles have hinged panels extending the full length and width of the engines to permit engine changes to be made while the aircraft is afloat.

ACCOMMODATION.—Crew of four—pilot, co-pilot, navigator/minelayer, and radio and armament defence operator. The interior arrangement of the hull includes, from nose to tail, a bow radome enclosing a radar scanner; main deck with pilot compartment; entrance compartment (with entrance door on the port side) which also serves for stowage for anchor and mooring gear; flight deck compartment for crew members; and a pressure lock for in-flight access to unpressurised areas. Beneath the flight deck is the electrical and electronics compartment. To the rear of the pressurised area is the mine-bay compartment, which includes a portion of the main wing in the upper section, fuel tanks, air conditioning and anti-icing equipment and tracks with a small trolley on which crew members pull themselves forward or aft above the store of mines or other equipment below. Aft of the mine-bay is the mine-loading compartment which extends the full height of the hull. Mines and other stores are loaded into this compartment through a large hatch in the top of the hull. Rear compartments house electronic equipment for the tail turret and the auxiliary power-plant. The flight deck can be pressurised to maintain a cabin altitude of 21,000 ft. (6,400 m.) against a true altitude of 50,000 ft. (15,250 m.). Ejection seats for all crew members. The mine-bay is fitted with a water-tight rotary mine door on which mines, stores or a camera pod can be installed while the aircraft is afloat or on its beaching-gear. Ashore, the mine-door can be removed completely and replaced by another which has been



The Martin XP6M-1 SeaMaster.



The Martin XP6M-1 SeaMaster Flying-boat (four Allison J71 turbojet engines).

pre-loaded. Watertightness is assured,by a self-sealing rubber pneumatic tube system.

DIMENSIONS.—
Span 100 ft. (30.48 m.).
Length 134 ft. (40.84 m.).
Height 31 ft. (9.45 m.).

WEIGHT.—
Payload 30,000 lb. (13,608 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.).
Normal cruising height 40,000 ft. (12,200 m.).
Combat radius on internal tankage 1,500 miles (2,415 km.).

THE MARTIN MODEL 237 MARLIN.
U.S. Navy designation: P5M.

The P5M was the first twin-engined flying-boat to be developed for the U.S. Navy for anti-submarine warfare since the war.

The most characteristic feature of the P5M is the hull design, which resulted from a long series of tests made, in co-operation with the Navy and the National Advisory Committee for Aeronautics, with models in the towing tank of the Stevens Institute of Technology.

From the shallow Vee step aft the hull is characterised by its depth and length. This long afterbody is designed to permit safer alightings on rough water without excessive pitching and bouncing, and to reduce normal take-off time and distance.

The first experimental prototype to test the new hull design, later to become the XP5M-1, was a hybrid, the experimental hull being fitted with a set of PBM Mariner wings off the production line. A single fin and rudder replaced the twin tail of the Mariner and Wright R-3350 engines were installed. Control power boost was added. The prototype XP5M-1 flew for the first time on May 4, 1948, and was tested by the U.S. Navy in 1949-50.

Engineering for the production version was directed towards producing the most potent ASW weapon. The Marlin is equipped with powerful tactical radar and the latest types of magnetic airborne detection equipment, sonobuoys, searchlight, cameras for reconnaissance and damage-assessment, etc.

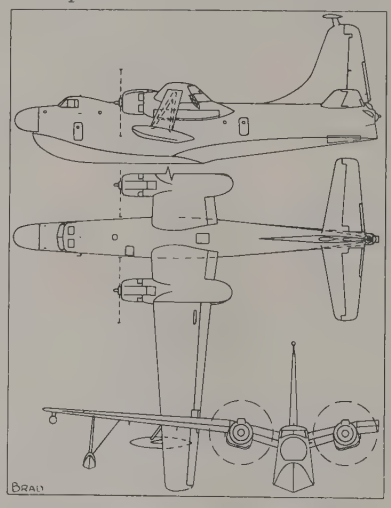
Substantial orders for the P5M have been received by the Martin company. Production was started in January, 1950.

Two versions of the Marlin exist. These are identified as follows :—

P5M-1. Two 3,250 h.p. Wright R-3350-30WA. Turbo Compound engines. First production version. Low tailplane. First production Marlin flew for the first time on June 22, 1951, and the first P5M-1 was delivered to the U.S. Navy in December, 1951. Deliveries continued throughout 1953 and into 1954. A number of ASR versions of the P5M-1 were delivered to the U.S. Coast Guard in the Autumn of 1953.

Under a programme announced in April, 1957, eighty P5M-1 Marlins are to be modernised, by the addition of magnetic airborne detection (MAD) equipment and improvements in the power-plant systems, electrical and electronic systems. The programme will extend through 1959.

P5M-2. Two 3,450 h.p. Wright R-3350-32W Turbo Compound engines. Development of P5M-1. Chief external difference is the new "T" tail with the horizontal surfaces on top of the fin. Also has a lower bow chine line to reduce spray damage to the airscrews, increased fuel capacity, the latest ASW electronic equipment, and a rearrangement of much of the interior equipment for greater operational comfort and convenience. In production. The first P5M-2 first flew in August, 1953. First P5M-2 delivered to U.S. Navy on June 23, 1954.



The Martin P5M-1 Marlin.

The general structure of the P5M-1 and P5M-2 is similar. The description below applies primarily to the P5M-2 except where indicated.

TYPE.—Twin-engined Anti-Submarine Warfare flying-boat.

WINGS.—Gull-wing cantilever monoplane. Wing section NACA 23020 at root, NACA 4412 at tip. Dihedral 16° inner gull section, 3° outboard of nacelles. Gull-wing centre-section integral with hull, outer panels and tips removable. Goodrich de-icing boots on leading-edges. All-metal three-spar box structure. Conventional trailing-edge ailerons have metal D-spar leading-edges, metal ribs and fabric covering. All-metal spoiler ailerons operating in conjunction with the conventional ailerons to counteract any rolling tendencies that might develop at take-off or alighting in rough water, are located inboard of main ailerons in line of rear spar. All-metal trailing-edge flaps between ailerons and nacelles and nacelles and hull. Total conventional aileron area (including tabs) aft of hinge line 65.93 sq. ft. (6.13 m.²). Total spoiler aileron area 46.49 sq. ft. (4.32 m.²). Total flap area 204.3 sq. ft. (18.97 m.²). Gross wing area (including 103.32 sq. ft.=9.59 m.² of hull) 1,406.33 sq. ft. (130.65 m.²).

HULL.—All-metal semi-monocoque structure. Single faired V-type step and long planing afterbody. New lower bow chine line, as compared with P5M-1, results in reduction of spray height and permits take-off in heavier seas at greater A.U.W. Martin-developed hydraulically-operated hydro-flaps one on each side of after hull bottom serve as water rudders when operated individually or as water brake or sea anchor when both extended together. All-metal wing-tip stabilising floats.

TAIL UNIT (P5M-2).—Cantilever all-metal T-type structure. Areas: fin, including 26 sq. ft.=2.41 m.² of dorsal fin and 17.7 sq. ft.=1.64 m.² of contained rudder balance 177 sq. ft. (16.44 m.²), rudder, aft of hinge



The Martin P5M-1 Marlin Flying-boat (two 3,250 h.p. Wright Turbo Compound engines).



The Martin P5M-2 Marlin Flying-boat (two 3,450 h.p. Wright Turbo Compound engines). (*Gordon Williams*).

line, 49 sq. ft. (4.55 m.²), tailplane including 32.4 sq. ft.=3.0 m.² of contained elevator balance 173 sq. ft. (1.60 m.²), elevators, aft of hinge line 89 sq. ft. (8.26 m.²).

POWER PLANT.—Two 3,250 h.p. Wright R-3350-30WA (P5M-1) or 3,450 h.p. R-3350-32W (P5M-2) Turbo Compound engines. Hamilton Standard airscrews. Fuel tanks in hull and centre wing section are of self-sealing Mareng type. Two non-self-sealing auxiliary tanks outboard of service tanks, one in each wing panel. Provision for jettisoning fuel and for purging interior of auxiliary tanks and spaces surrounding hull tanks with carbon-dioxide for combat protection. Two droppable tanks can be installed, one in each nacelle bomb-bay. Total fuel capacity (P5M-1 and P5M-2) 3,975 U.S. gallons (15,047 litres).

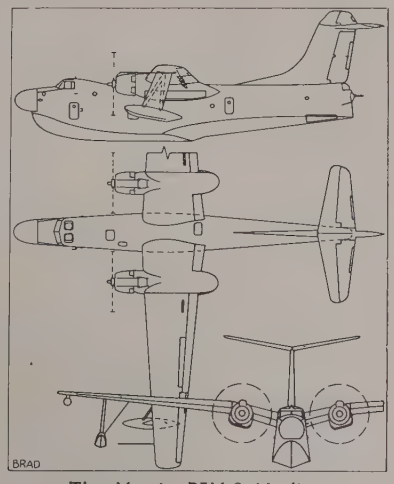
ACCOMMODATION.—Crew of eleven. Details of interior accommodation not available.

ARMAMENT.—Defensive armament in tail-turret. Bomb-bays in engine nacelles for various types of offensive stores.

EQUIPMENT.—Magnetic airborne detector (AN/ASQ-8 MAD) unit in tubular plastic fairing extending aft from horizontal-vertical tail juncture. AN/APS-44A radar scanner in nose radome. Camera installation for damage estimation by day or by night in streamline pod which can be attached to outside of hull. Hoisting points on centre-line of hull at wings for hoisting craft aboard seaplane tender at 60,000 lb. (27,240 kg.) gross weight. Beaching-gear to support gross weight of 78,500 lb. (35,640 kg.) can be stowed aboard dis-assembled.

DIMENSIONS (P5M-1).—
Span 118 ft. 2¼ in. (36.0 m.).
Length 94 ft. 6 in. (28.82 m.).
Height 38 ft. 5 in. (11.71 m.).

DIMENSIONS (P5M-2).—
Span 118 ft. 2¼ in. (36.0 m.).



The Martin P5M-2 Marlin.

Length 98 ft. 11 in. (30.18 m.).
Height 33 ft. (10.06 m.).

WEIGHTS (P5M-1).—
Weight empty 46,642 lb. (21,175 kg.).
Weight loaded 72,837 lb. (33,070 kg.).

WEIGHTS (P5M-2).—
Weight empty 46,933 lb. (21,310 kg.).
Weight loaded 73,055 lb. (33,166 kg.).

PERFORMANCE.—
Max. speed at S/L. (P5M-1) 237 m.p.h. (381 km.h.).
Max. speed at S/L. (P5M-2) 245 m.p.h. (394 km.h.).
Max. diving speed 303 m.p.h. (487 km.h.).
Alighting speed 99 m.p.h. (159 km.h.).
Range 2,880 miles (4,630 km.).

THE MARTIN MATADOR.
U.S.A.F. designations: TM-61 and TM-76.

First tactical bombardment missile to enter service with the U.S.A.F., the Matador made its first flight in December, 1950 and became operational in March, 1954. Squadrons are stationed at present at Orlando, Florida and in Germany.

Powered by an Allison J33-A-37 turbojet, the Matador has a conventional sweptwing airframe with the tailplane mounted at the tip of the rudder. It is ground-launched from a mobile ramp with the aid of an Aerojet T50 solid-propellant booster rocket, which is jettisoned when its fuel is exhausted. The missile is controlled electronically in flight by ground personnel and can be fitted with nuclear or conventional warhead. Three versions have been produced :—

TM-61A. Initial production version.

TM-76A (formerly TM-61B). Longer, more rounded nose. New Atran guidance system. Announced March, 1956.

TM-76B (formerly TM-61C). Shanicle guidance system, giving better control when several missiles are in the air at once, greater accuracy, complete all-weather operational ability and high resistance to electronic counter-measures. Longer range. Announced April, 1957.

Specification details of these missiles are given in the "Guided Missiles" section.



The Martin TM-76A (formerly TM-61B) Tactical Bombardment Missile (Allison J33-A-37 expendable turbojet).

MOONEY

MOONEY AIRCRAFT INC.

HEAD OFFICE AND WORKS: LOUIS SCHREINER FIELD, KERRVILLE, TEXAS.

President and Chairman of the Board: Hal F. Rachal.

Executive Vice-President and Sales Manager: Norman F. Hoffman.

Secretary-Treasurer: E. B. Hunnicutt.

General Manager: E. Herbert Andersen, Jr.

Acting Chief Engineer: John W. Taylor.

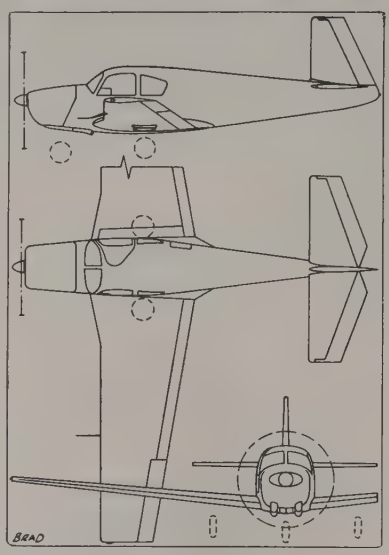
The Mooney Aircraft, Inc. was formed to build the M-18 single-seat light monoplane, which was designed for extremely economical operation and has been described fully in earlier editions of "All the World's Aircraft."

One M-18C has been converted into a pilotless "drone" for the U.S. Army, to flight test experimental radio control units, under the designation XM-27. Modifications include fitting a new Flottorp controllable-pitch airscrew and wing-tip end-plates.

Its current product is the M-20 four-seat cabin monoplane which received its Approved Type Certificate in August, 1955.



The Mooney M-20 Mk. 20 (150 h.p. Lycoming O-320 engine).



The Mooney M-20 Mk. 20.

THE MOONEY M-20 MARK 20.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. NACA laminar-flow wing section. Laminated single-piece single-spar structure with plywood torsion-box covering. Manually-operated three-position narrow-chord slotted flaps over 70 per cent. of trailing-edge. Sealed gap differentially-operated ailerons. Total area of ailerons 11.1 sq. ft. (1.03 m.²). Total area of flaps 17.2 sq. ft. (1.6 m.²). Gross wing area 166.9 sq. ft. (15.50 m.²).

FUSELAGE.—Composite all-metal structure. Cabin section is of welded steel-tube with sheet aluminium-alloy covering. Rear section is of aluminium-alloy with internal formers and stringers.

TAIL UNIT.—Cantilever monoplane type. Variable-incidence tailplane and fin move together for trim control. Both are single spar structures with plywood torsion-box leading-edge and plywood covering aft. All control surfaces have welded steel-tube frames with fabric covering. Areas: tailplane 21.5 sq. ft. (2 m.²), elevators 12 sq. ft. (1.11 m.²), fin 5 sq. ft. (.46 m.²), rudder 7.9 sq. ft. (.73 m.²). Tailplane span 11 ft. 8 in. (3.55 m.).

LANDING GEAR.—Retractable nose-wheel type. Rubber-in-compression with rebound control shock-absorbers. Steerable nose-wheel. Hand retraction by lever in cockpit between front seats. Hydraulic brakes on main wheels. Track: 9 ft. 2 in. (2.79 m.). Wheelbase: 5 ft. $6\frac{5}{16}$ in. (1.68 m.).

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Hartzell two-blade all-metal constant-speed airscrew with Hamilton Standard governor. Diameter of airscrew 6 ft. 2 in. (1.88 m.). Fuel capacity 50 U.S. gallons (190 litres) in two $17\frac{1}{2}$ gallon wing tanks and one 15 gallon reserve tank.

ACCOMMODATION.—Cabin seats four in two pairs, front pair with dual controls. Starboard front and rear seats removable for freight stowage. Single door on starboard side giving access to all seats. Baggage compartment behind cabin with access from cabin or through outside door.

DIMENSIONS.—
Span 35 ft. (10.67 m.).
Length 23 ft. $2\frac{5}{8}$ in. (7.07 m.).
Height 8 ft. $3\frac{1}{2}$ in. (2.52 m.).

WEIGHTS AND LOADINGS.—
Weight empty equipped 1,415 lb. (642 kg.).
Pilot and 3 passengers 680 lb. (310 kg.).
Fuel and oil 315 lb. (143 kg.).
Baggage 120 lb. (54 kg.).
Weight loaded 2,450 lb. (1,112 kg.).
Wing loading 14.67 lb./sq. ft. (70.36 kg./m.²).
Power loading 16.33 lb./h.p. (7.41 kg./h.p.).

PERFORMANCE (Standard airscrew).—
Max. speed at S/L. 171 m.p.h. (275 km.h.).
Optimum cruise (75% power) at 4,900 ft. (1,495 m.) 165 m.p.h. (265 km.h.).
Economic cruise (60% power) at 10,000 ft. (3,050 m.). 150 m.p.h. (240 km.h.).
Landing speed (flaps at 50°) 57 m.p.h. (92 km.h.).
Rate of climb at S/L. 900 ft./min. (275 m. min.).
Service ceiling 17,200 ft. (5,240 m.).
Absolute ceiling over 20,000 ft. (6,100 m.)
Range at optimum cruise 750 miles (1,207 km.) in 4.6 hours.
Range at economic cruise 900 miles (1,450 km.) in 6 hours.

NAGLER

NAGLER HELICOPTER COMPANY, INC.

HEAD OFFICE AND WORKS: WESTCHESTER COUNTY AIRPORT, WHITE PLAINS, NEW YORK.

President: Bruno Nagler.

Vice-President: R. G. Anderson.

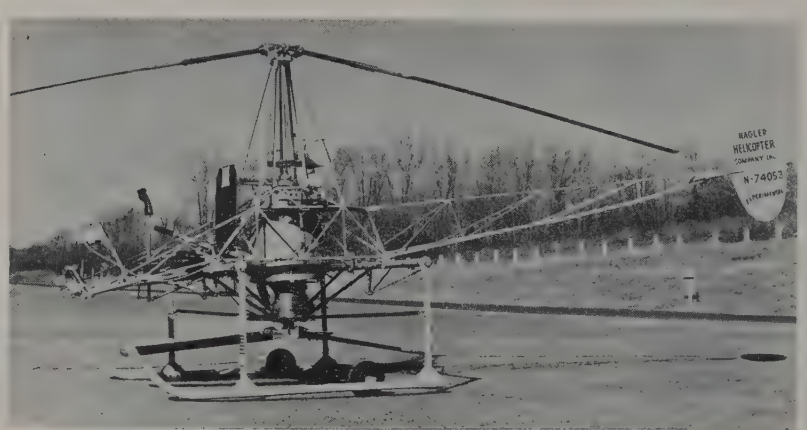
Secretary: Walter Duke.

Treasurer: Samuel Mandel.

This company has built and flown a single-seat experimental helicopter known as the Nagler Model NH-160 which embodies radically new principles of power transmission, in that the upper and lower rotors are driven directly through extension shafts by the crankcase and crankshaft respectively. This completely eliminates the need for transmissions, gearboxes, drive-belts, or other means of power delivery.

During powered flight, the lower rotor provides the primary driving force, while the upper rotor, through a conventional swashplate control system, primarily guides the aircraft and provides a counter-torque reaction for the lower rotor. Due to the fact that the lower rotor is the primary lifting surface, the upper rotor in effect becomes very lightly loaded, thus allowing it to operate at very low angles of attack.

The NH-160 flew for the first time in December, 1955 and is described hereafter.



The Nagler NH-160 Helicopter (72 h.p. McCulloch engine).

THE NAGLER NH-160.

TYPE.—Single-seat Experimental helicopter.

ROTOR SYSTEM.—Two-blade upper rotor, driven directly by engine crankcase. Wooden blades, with spruce spar and plywood covering, attached to the crankcase extension shaft by a steel pin inserted through both flapping hinges. These are solid steel bars which are retained in the rotor cuff bearings by snap rings. The rotor cuff is attached to the blade by a series of bolts through the main spar of the blade. Area of each blade 6.02 sq. ft. (0.56 m.²). Disc area of upper rotor 323 sq. ft. (30 m.²). Three-blade lower rotor, mounted under engine, is of similar construction to the upper rotor and is attached to the crankshaft through a rigid see-saw hinge. It is the primary lifting surface, receiving a power input approximately five times that of the upper rotor. Torque balance between the two rotors is introduced aerodynamically and is automatically compensated for by the engine. Disc area of lower rotor 51.5 sq. ft. (4.79 m.²).

FUSELAGE.—Open welded steel-tube structure.

LANDING GEAR.—Fixed skid type. Track 7 ft. 6 in. (2.29 m.).

POWER PLANT.—One McCulloch Type 4318A four-cylinder horizontally-opposed air-cooled two-stroke engine, giving 72 h.p. at

4,000 r.p.m. Suspended in bearings which allow complete rotation.
ACCOMMODATION.—Open seat for pilot only.
DIMENSIONS.—
Upper rotor diameter 20 ft. 7 in. (6.27 m.).
Lower rotor diameter 8 ft. 1 in. (2.46 m.).
Overall length 21 ft. 11 in. (6.68 m.).
Length of fuselage 16 ft. (4.88 m.).
Overall width 7 ft. 7 in. (2.31 m.).
Height 7 ft. (2.13 m.).
WEIGHTS.—
Weight empty 500 lb. (227 kg.).
Weight loaded 660 lb. (300 kg.).
PERFORMANCE.—
No details available.

NATIONAL

NATIONAL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: 3411, TULARE AVENUE, BURBANK, CALIFORNIA.

The Manufacturing Division of National Aircraft Corporation has designed an agricultural aircraft known as the NA-75, which consists of a modified Stearman Model 75 (Boeing Kaydet) fuselage, fitted with new high-lift wings of metal construction and dispersal equipment that permits instantaneous changeover from dust to spray.

The NA-75 is available as a complete aircraft. Alternatively, the new wings, a fuselage modification kit and the dust-spray equipment can be obtained individually for easy conversion of existing Stearmans, and many operators of agricultural aircraft in the United States, Canada, Cuba, Hawaii and Mexico have converted their Stearmans in this way.



The National NA-75 Agricultural Biplane, based on the Stearman Model 75.

THE NATIONAL NA-75.

TYPE.—Single-seat Agricultural aircraft.
WINGS.—Single-bay unequal-span staggered biplane. Göttingen 398 wing section. Chord 5 ft. 5 in. (1.65 m.). Incidence (upper) 4°, (lower) 2°. Dihedral (upper) ½°, (lower) 1½°. All-metal stressed skin centre-section has all flight and engine instruments located in trailing edge and is carried above fuselage by splayed-out wire-braced streamline steel-tube struts. One original Stearman "N"-type streamline steel-tube interplane strut assembly on each side of fuselage, with chrome-molybdenum wire cutters on leading edge. Wings have all-metal structure, fabric-covered except for leading edges which are assembled in small sections for ease of replacement without disturbing fabric. Fabric is attached by clips. Metal ailerons and end-plates on all four wings. Wing area 338.26 sq. ft. (31.43 m.²).
FUSELAGE.—Rectangular welded chrome-molybdenum steel-tube structure, covered with quickly-removable metal panels.
TAIL UNIT.—Standard Stearman unit. Wire-braced monoplane type. Welded chrome-molybdenum steel-tube framework with fabric covering. Trim-tabs in each elevator. Chrome-molybdenum wire cutter on leading edge of fin.
LANDING GEAR.—Standard Stearman units. Divided cantilever type. Torque-resisting oleo-spring shock-absorbers enclosed in metal fairings. Wire-cutters on leading-edges of fairings. Double-action Servo brakes Steerable tail-wheel..
POWER PLANT.—One 220 h.p. Continental R-670, or 225 h.p. Lycoming R-680-B4 or 300 h.p. Lycoming R-680-E3, or 245 h.p. Jacobs R-755, or 300 h.p. Jacobs R-915, or 425 h.p. Wright R-975, or 450 h.p. Pratt & Whitney R-985 radial air-cooled engine on steel-tube mounting. Two-blade adjustable-pitch metal airscrew. Fuel tank in centre-section.
ACCOMMODATION.—One open cockpit, with crash pads forward of seat and around coaming.
EQUIPMENT.—Combination 31.7 cub. ft. (0.897 m.³) reinforced Fiberglass dust-spray hopper forward of cockpit with aerofoil-type dust spreader under fuselage and spray-booms along trailing-edge of lower wings. Provision for dumping load in 5 seconds. Spray pump and dust agitator engine-driven through variable-speed power take-off, controllable in flight.
DIMENSIONS.—
Span (upper) 33 ft. 0½ in. (10.07 m.).
Span (lower) 29 ft. 5 in. (8.97 m.).
Length 24 ft. 9 in. (7.54 m.).
WEIGHTS.—
Weight loaded 2,612-4,612 lb. (1,185-2,092 kg.) depending on engine and payload.
PERFORMANCE (220 h.p. R-670 engine).—
Stalling speed with 500 lb. (227 kg.) load 41 m.p.h. (66 km.h.).
Stalling speed with 1,250 lb. (567 kg.) load 55 m.p.h. (88.5 km.h.).
Rate of climb at S/L. with 500 lb. (227 kg.) load 660 ft./min. (200 m./min.).
Rate of climb at S/L. with 1,250 lb. (567 kg.) load 420 ft./min. (128 m./min.).
Take-off distance with 500 lb. (227 kg.) load 645 ft. (197 m.).
Take-off distance with 1,250 lb. (567 kg.) load 890 ft. (270 m.).
PERFORMANCE (450 h.p. R-985 engine).—
Stalling speed with 500 lb. (227 kg.) load 41 m.p.h. (66 km.h.).
Stalling speed with 1,250 lb. (567 kg.) load 55 m.p.h. (88.5 km.h.).
Rate of climb at S/L. with 500 lb. (227 kg.) load 1,110 ft./min. (338 m./min.).
Rate of climb at S/L. with 2,000 lb. (907 kg.) load 550 ft./min. (168 m./min.).
Take-off distance with 500 lb. (227 kg.) load 330 ft. (100 m.).
Take-off distance with 2,000 lb. (907 kg.) load 785 ft. (240 m.).

NORTH AMERICAN

NORTH AMERICAN AVIATION, INC.

HEAD OFFICE: INTERNATIONAL AIRPORT, LOS ANGELES 15, CAL.

AIRCRAFT PRODUCTION PLANTS: LOS ANGELES AND FRESNO, CALIFORNIA, AND COLUMBUS, OHIO.

MISSILE DEVELOPMENT DIVISION: DOWNEY, CALIFORNIA.

ROCKETDYNE DIVISION: CANOGA PARK, CALIFORNIA AND NEOSHO, MISSOURI.

ATOMICS INTERNATIONAL DIVISION: CANOGA PARK, CALIFORNIA.

AUTONETICS DIVISION: DOWNEY, CALIFORNIA.

Chairman of the Board: J. H. Kindelberger.

President: J. L. Atwood.

Vice-President and General Manager of Los Angeles Division: R. H. Rice.

Vice-President, Administration: J. S. Smithson.

Vice-President and Treasurer: R. A. Lambeth.

Vice-President, General Counsel: G. B. Brophy.

Vice-President, Engineering and Planning: L. L. Waite.

Vice-President and General Manager of Columbus Division: C. J. Gallant.

Vice-President and General Manager of Atomics International: D. Chauncey Starr.

Vice-President: A. T. Burton.

Director of Development Planning: Rear-Admiral J. B. Pearson, Jr.

Secretary: S. G. Anspach.

North American Aviation, Inc., was incorporated in Delaware in 1928 and from 1934 until 1945 was engaged solely in the design and manufacture of military aircraft. Manufacturing facilities were established at Inglewood, California, in 1935, where a modern production plant was erected on the Los Angeles Municipal (now International) Airport. Other facilities have since been acquired in the Los Angeles area.

In 1956, the company delivered aircraft of eight different types for use by the U.S. Air Force, U.S. Navy, U.S. Marine Corps and N.A.T.O. countries.

During the year, the Los Angeles Division produced the F-100C and F-100D Super Sabre, completed production of the F-86F Sabre, and started production of the F-100F, a two-seat version of the Super Sabre. This Division was also engaged in development work on several other projects, including the X-15 hypersonic piloted research aircraft, the WS-110A chemical-fuel bomber, the Sabreliner twin-jet transport and combat readiness trainer, and a modification programme on the B-45 Tornado bomber and F-86D interceptor. In 1957, against strong competition, it won a U.S.A.F. design contest for a new long-range interceptor covered by the weapon system designation WS-202.

Production at the Columbus Division included the FJ-3 and FJ-4 Fury fighters and T-28B and T-28C trainers for the U.S. Navy and Marine Corps, and the F-100D Super Sabre. This Division also received development contracts for a two-seat jet trainer, the T2J, and a supersonic attack aircraft, the A3J, for the Navy.

The Fresno Division was concerned during 1956 primarily with the modernisation, modification, inspection and repair of F-86 day fighters and F-86D interceptors already in service use.

The company also produced parts to support the assembly of F-86K interceptors being built under licence in Italy, and F-86F fighters being built in Japan. Sabre fighters were also being built under licence in Canada and Australia during 1956.

Announcement was made by the U.S.A.F. in March, 1955 that the North American Missile Development Division was developing the SM-64 Navaho long-range surface-to-surface strategic missile; but further work on this weapon was abandoned in July, 1957, although it had by then completed at least one successful flight test. An unmanned supersonic twin-turbojet test vehicle known as the X-10 was developed and used to flight test aerodynamic features, electronics equipment and general flight characteristics of the Navaho under a programme which was completed in 1956.

Establishment of the Los Angeles Division and of the Missile Development Division as separate operating divisions was announced during that year. This followed the creation during 1955 of the Rocketdyne, Autonetics and Atomics International Divisions. Of these, the Rocketdyne Division is responsible for all development, testing and production in the rocket engine category; the

Atomics International Division has responsibility for all nuclear engineering and manufacture; and the Autonetics Division handles all development and production in the field of automatic navigation and control equipment.

Total employment in all North American Divisions at the end of the company's 1956 fiscal year exceeded 70,000.

THE NORTH AMERICAN X-10.

The X-10 was an unmanned twin-turbojet test vehicle for the SM-64 Navaho intercontinental cruise missile. It flew many hundreds of miles at supersonic speeds before its test programme was completed. Full details are given in the "Guided Missiles" section of this work.

THE NORTH AMERICAN X-15.

Following preliminary studies by the N.A.C.A. and an industry-wide design competition, North American has been awarded a U.S.A.F./U.S.N./N.A.C.A. contract for the development of a manned research aircraft which will have a designed speed of Mach 10 and will be capable of reaching an altitude of 750,000 ft. (228,000 m.). Known as the X-15, this aircraft is being developed to obtain data particularly with regard to heating, stability, control and the problems of re-entry into the atmosphere. All design details and problems encountered during development are being made available immediately to the entire U.S. aircraft industry.

Smaller and lighter than the Bell X-1 and X-2, the X-15 will be powered by a Reaction Motors liquid-propellent rocket engine with a reported thrust of 20,000 lb. (9,080 kg.). It will probably have small wing-tip rockets or air-jets for directional control at extreme altitudes.

The U.S.A.F. announced in April, 1957 that fabrication of the X-15 had started and that wind tunnel tests of its design were then almost completed. It is not expected to fly until 1959 and the first prototype is expected to achieve Mach 5 at 250,000 ft. (76,000 m.), prior to research at higher speeds with later models.

THE NORTH AMERICAN SABRELINER.

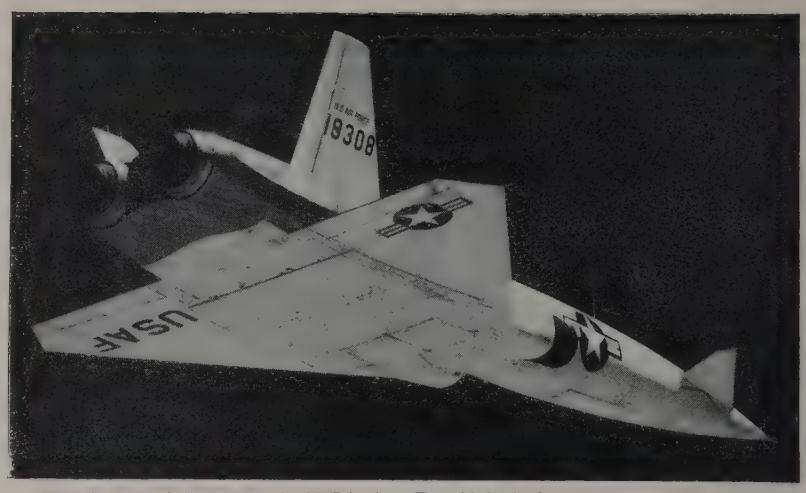
To meet U.S.A.F. requirements for a staff transport and combat readiness trainer, North American is building as a private venture the prototype of a small sweptwing twin-jet transport named the Sabreliner. Wind tunnel tests and 25% of the engineering work had been completed by August 31, 1956, and the prototype is expected to fly early in 1958. Commercial and executive transport versions will also be offered.

The Sabreliner is designed to be powered by two General Electric J85 turbojets mounted in pods on the sides of the rear fuselage. It will carry a crew of two and four passengers for distances up to about 1,500 miles (2,400 km.) with reserves. Alternative cabin layouts will enable up to nine passengers to be carried. The flight deck and cabin will be pressurised to maintain an equivalent altitude of 8,000 ft. (2,440 m.) while cruising at 45,000 ft. (13,700 m.).

DIMENSIONS.—
Span 42 ft. 6 in. (12.95 m.).
Length 44 ft. (13.41 m.).

WEIGHT.—
Weight loaded approx. 14,000 lb. (6,350 kg.).

PERFORMANCE (estimated).—
Max. cruising speed 500 m.p.h. (800 km.h.).



The North American X-10 Pilotless Test Vehicle for the now-cancelled Navaho missile.

THE NORTH AMERICAN A3J.

In September, 1956, the U.S. Navy placed a contract worth $86M for a supersonic twin-jet attack bomber to be known as the A3J. It will carry a crew of two. No further details are available.

THE NORTH AMERICAN F-107A.

The F-107A, originally designated F-100B, is an advanced single-seat fighter-bomber development of the F-100 Super Sabre. It is powered by a Pratt & Whitney J75 engine, the bifurcated air intakes for which are on top of the fuselage behind the cockpit.

The first prototype made its maiden flight in September, 1956 and is reported to have exceeded Mach 2.0 during subsequent test flights at Edwards A.F.B., California. Further development was cancelled as an economy move in 1957.

DIMENSIONS.—
Span 38 ft. (11.58 m.).
Length 47 ft. (14.33 m.).

THE NORTH AMERICAN SUPER SABRE.
U.S. Air Force designation: F-100.

The F-100 was the first supersonic operational fighter to be developed for the U.S.A.F. The prototype YF-100A, powered by a Pratt & Whitney J57-P-7 turbojet engine fitted with an afterburner, flew for the first time on May 25, 1953. It exceeded the speed of sound in level flight on its first 35-minute flight.

On August 20, 1955, Colonel H. A. Hanes, U.S.A.F., flying an F-100C Super Sabre established the first supersonic speed record of 822.125 m.p.h. (1,323 km.h.).

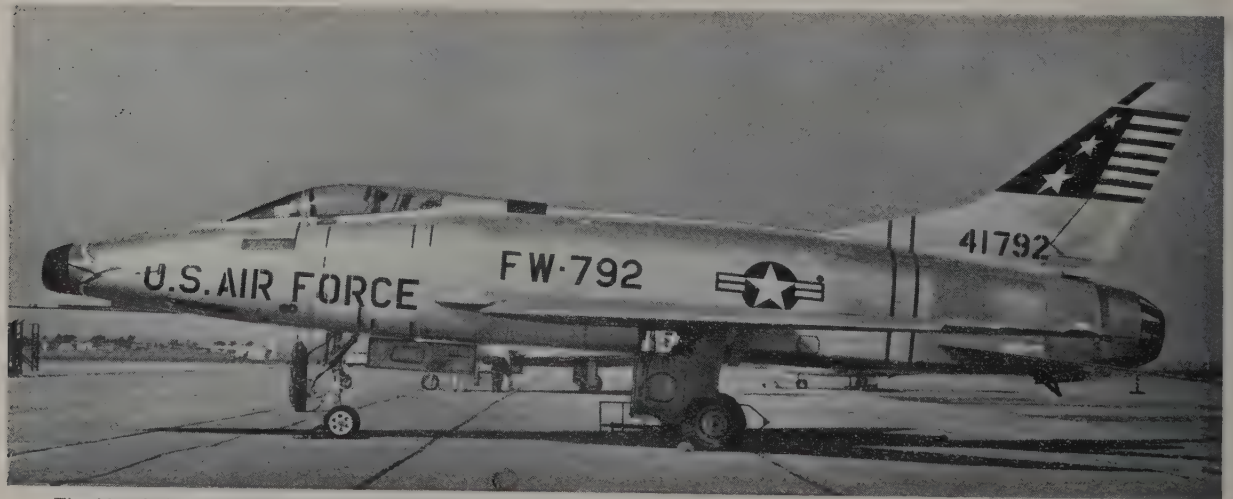
Five versions of the F-100 have been announced, as follows :—

F-100A. Initial production version. Day fighter with Pratt & Whitney J57-P-7 turbojet engine, with afterburner. In production at North American's Los Angeles plant from mid-1953. Production completed in 1955.

F-100B. All-weather fighter. Design was revised sufficiently to justify redesignation as F-107A (which see).

F-100C. Fighter-bomber with Pratt & Whitney J57-P-21 engine. Fitted with in-flight refuelling for internal tanks only and provision for carrying extra drop fuel tanks and bombs under the wings. Improved electronic bombing equipment. Standard armament of four 20 mm. cannon. First F-100C from Los Angeles Division flew on January 17, 1955. Production also undertaken by Columbus Division and first Colombus-built F-100C flown in September, 1955.

F-100D. Fighter-bomber. Similar to F-100C with improvements that include the fitting of flight refuelling probe for



The North American F-100C Super Sabre (Pratt & Whitney J57 turbojet engine and afterburner). *(Gordon Williams).*



The North American F-100D Super Sabre (Pratt & Whitney J57 turbojet engine and afterburner).

replenishing both internal and external tanks, wing flaps on centre-section trailing-edge, tail-warning radar and a Minneapolis Honeywell autopilot. This latter is able to control the aircraft at supersonic speed, leaving the pilot free to concentrate on navigation and tactics. First flight of F-100D on January 24, 1956.

F-100F. Two-seat version able to be used as fighter-bomber, air-superiority fighter or trainer. Fixed armament reduced from four to two M-39 cannon. Ordered into production in 1956. Prototype (designated TF-100C) flew on August 12, 1956 and the first production F-100F on March 8, 1957. Length increased by 3 ft. (0.91 m.).

A "buddy" system of flight refuelling has been developed for the F-100 by Flight Refueling Inc. of Baltimore, Maryland. Under this system, one F-100 is able to take fuel from another which trails a hose and drogue from a standard-size streamlined external pod carried under its wing. Upon completion of the operation, the entire equipment retracts automatically into the pod, so that performance is not penalised. In addition to the fuel available within the refuelling pod, the F-100 "tanker" is able to dispense fuel from its external tanks.

First tests of this new "buddy" system were made successfully by two F-100D Super Sabres early in 1957.

The following brief description refers specifically to the F-100C.

TYPE. — Single-seat supersonic Fighter-bomber.

WINGS.—Low-wing cantilever monoplane with 7% thickness-chord ratio. 45° sweepback, aluminium alloy spars, ribs and tapered skin. Inset ailerons each split into two sections. Automatic leading-edge slats. No flaps.

FUSELAGE.—All-metal structure. Rectangular air brake hinged beneath fuselage approximately in line with front wing spar.

TAIL UNIT.—Monoplane type. All surfaces have 45° sweepback. One-piece "all-flying horizontal stabiliser. Braking parachute housed at base of rudder. Span of tail 18 ft. (5.5 m.).

LANDING GEAR.—Retractable tricycle type, with steerable twin nose-wheels. Hytrol anti-skid sensing units on segmented-rotor brakes. Track of main wheels 12 ft. (3.6 m.).

POWER PLANT.—One Pratt & Whitney J57-P-21 turbojet engine with afterburner. Automatic fuel system. Total internal fuel capacity 1,195 U.S. gallons (4,523 litres) in wing, fuselage and annular engine-bay tanks, filled from single point on port rear fuselage. Two under-wing 275 U.S. gallon (1,041 litre) tanks may be carried. Provision for flight refuelling internal tanks only. Probe on starboard wing inboard of underwing tank shackles.

ACCOMMODATION.—Pilot's cockpit forward of wings with one-piece clamshell-type jettisonable canopy. Automatically-regulated air conditioning and pressurising system. Ejection seat.

ARMAMENT.—Four 20 mm. M-39E cannon with 200 rounds per gun. Six under-wing pylons for up to 6,000 lb. (2,720 kg.) of H.E. or Napalm bombs, 24 × 5 in. rockets, pods of 2.75 in. air-to-air rockets, etc. Type A-4 radar gunsight.

DIMENSIONS.—
Span 38 ft. (11.58 m.).
Length 47 ft. (14.33 m.).
Height 16 ft. (4.88 m.).

WEIGHT.—
Weight loaded approx. 28,000 lb. (12,700 kg.).

PERFORMANCE.—
Max. speed with afterburner 750-760 m.p.h. (1,200-1,216 km.h.) at S/L.
Stalling speed approx. 150 m.p.h. (241 km.h.).
Landing speed approx. 179 m.p.h. (287 km.h.).
Service ceiling over 50,000 ft. (15,250 m.).
Combat radius 575 miles (920 km.).
Take-off run with afterburning approx. 4,500 ft. (1,370 m.).

THE NORTH AMERICAN SABRE.
U.S. Air Force designation: F-86.

The F-86 was the first American swept-wing fighter to go into combat. In two years of fighting in Korea the F-86 set up an impressive combat record.

Production of the Sabre by North American came to an end in December, 1956, after nine years; but versions are still being built under licence in Canada by Canadair, Ltd. and in Australia by the Commonwealth Aircraft Corporation Pty. Ltd. The Canadian production Sabre has been supplied in quantity to the R.C.A.F., U.S.A.F., R.A.F. and the air forces of several other nations. The Australian-built Sabre is fitted with the Rolls-Royce Avon engine.

Under an agreement signed late in 1955, North American is supplying parts for the assembly in Japan by the Mitsubishi company of F-86F Sabres for the Japanese Air Self-Defence Force.

The F-86K has been ordered by the U.S.A.F. under the Mutual Defense Assistance Programme for production in Italy by Fiat for N.A.T.O. countries.

The following are the principal versions of the F-86 :—

XF-86. Two prototypes originally fitted with the Allison J35-GE-3 engine. First prototype flew on October 1, 1947. Were later re-engined with the General Electric J47. Re-engined XF-86 first exceeded Mach 1 on April 25, 1948.

F-86A. First production model. One General Electric J47-GE-1, -3, -9 and -13 engines in successive production series. First production aircraft flew on May 20, 1948. Out of production in December, 1950.



The North American F-100F Super Sabre (Pratt & Whitney J57 turbojet engine and afterburner).



The North American F-86D Sabre Single-seat All-weather Fighter (General Electric J47 turbojet engine). *(J. W. R. Taylor).*

F-86D. General Electric J47-GE-17 (5,200 lb.=2,360 kg. s.t.) in earlier production aircraft, and J47-GE-33 (7,650 lb.=3,470 kg. s.t.) in later aircraft, both engines with afterburners. All-weather interceptor. Air intake re-positioned under nose, which now encloses radar scanner. Larger rear fuselage to accommodate afterburner. All-flying tail. Armament consists of 24 × 2.75 in. rockets which are carried in a retractable launching tray located in the underside of the fuselage. Overall length 41 ft. (12.5 m.). Other dimensions as for F-86E. Prototype flew on December 22, 1949, and first production F-86D in March, 1951. The last was delivered in September, 1955.

F-86E. One General Electric J47-GE-13 engine (5,200 lb.=2,360 kg. s.t.). Progressive development of F-86A. First version to have "flying tail." In other respects similar to F-86A, which it followed on production line at Los Angeles in December, 1950. Production completed in April, 1952.

F-86F. One General Electric J47-GE-27 engine (5,800 lb.=2,630 kg. s.t.). Slightly larger and more powerful development of F-86E. Wing leading-edge extended forward 6 in. (15.2 cm.) at root and 3 in. (7.6 cm.) at tip, thus slightly increasing the angle of sweepback. Leading-edge slats eliminated and small fences added. First production F-86F flew on March 19, 1952. Aerodynamically-improved version re-ordered into production at Los Angeles in January, 1955. Also being built under licence in Japan by Mitsubishi.

F-86H. General Electric J73-GE-3 engine (9,300 lb.=4,218 kg. s.t.). Fuselage 6 in. (15.2 cm.) deeper. First armed with six 0.50-in. guns but later with four 20 mm. M-39 cannon. Higher powered fighter-bomber version of F-86F, with larger tailplane without dihedral, electrically-operated flaps, hydraulically-operated speed brakes and controls, heavier landing-gear, improved suspension and release mechanism for carrying droppable wing tanks in conjunction with bombs and rockets. Clamshell-type canopy as in F-86D, improved ejector seat, etc. Two prototypes built at Los Angeles, the first making its maiden flight on April 30, 1953. First production F-86H flew on September 4, 1953 and the type remained in production at Columbus until August, 1955. In service with "special weapons" units of the Twelfth U.S. Air Force in Europe. Span: 37 ft. 1 in. (11.3 m.). Length: 38 ft. 9 in. (11.8 m.). Height: 15 ft. (4.57 m.).

F-86K. General Electric J47-GE-33 engine (5,600 lb.=2,540 kg. s.t.) with afterburner. Ordered by U.S.A.F. with M.D.A.P. funds for delivery to N.A.T.O. countries. Similar to F-86D but fitted with four 20 mm. cannon instead of rocket armament and Type MG-4 fire control system. Fuselage is 8 in. (20.3 cm.) longer than that of F-86D. Being built under licence by Fiat in Italy. First U.S.-built YF-86K flew on July 15, 1954 and first production F-86K from Los Angeles plant in March, 1955.

F-86L. This designation has been given to F-86D aircraft after modification to new standards at Los Angeles Modification Center and Fresno plant. The F-86L accommodates "Data Link" equipment which receives intercept information and directions from the SAGE (Semi-Automatic Ground Environment) electronic air defence monitoring computer, and links data with pilot's instruments. F-86L's, in service with U.S.A.F. Air Defense Command, are being used to evaluate flying phase of SAGE which, when it becomes fully operational, will form, in conjunction with network of radar "picket" ships, early-warning radar aircraft and land-based radar stations, a solid interlocking radar ring around the United States through and over which it will be impossible to fly undetected. Other changes on the F-86L include a new slotted wing leading edge and new wing-tips that increase span by 2 ft. (0.60 m.). Deliveries began late in 1956. Contracts involve modification of over 800 F-86D interceptors to F-86L standard.

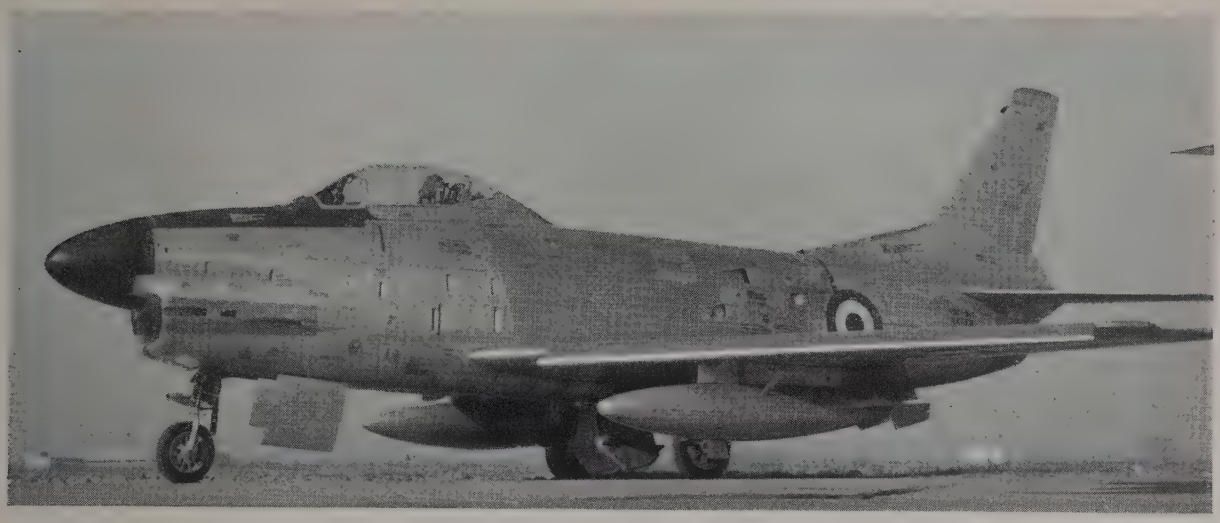
The description below refers to the F-86E.

TYPE.—Single-seat Fighter.

WINGS.—Low-wing cantilever monoplane. NACA 0012-64 (root), 0011-64 (tip) laminar-flow wing section. Maximum thickness at 50% of chord. 35° sweepback along 25% chord line. All-metal two-spar structure with upper and lower skins each of which is a sandwich consisting of two sheets



The North American F-86H Sabre Fighter (General Electric J73 turbojet engine) with cannon armament.



The North American F-86K Single-seat All-weather Interceptor Fighter as built by Fiat in Italy.

milled to tapering thickness separated by "hat" section extrusions, the whole forming a torsion-box structure. Ailerons over 55% of half span, 24% of chord. 10° up and down deflection. Aileron hydraulic boost and artificial fuel system. Split flaps inboard of ailerons, 60° maximum deflection. Leading-edge slots on outer 70% of span of each wing. Gross wing area 274 sq. ft. (25.4 m.²).

FUSELAGE.—Oval section all-metal structure with flush-riveted stressed skin. Air brakes on fuselage.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. All surfaces have 35° sweep-back. "Flying tail" in which elevators and tailplane are geared together and move differentially with movements of control column to provide in-flight trim. Column controls hydraulic valve which permits high-pressure fluid to flow into tailplane actuating cylinder. Artificial feel built in.

LANDING GEAR.—Retractable tricycle type with steerable nose-wheel. Hydraulic retraction. Cleveland 8657 air-oil shock struts. Bendix 26 in. (66 cm.) cast magnesium wheels and Bendix rotor-disc hydraulic brakes on main wheels. Track 8 ft. 3 in. (2.5 m.).

POWER PLANT.—One General Electric J47-GE-13 axial-flow turbojet (5,200 lb. = 2,360 kg. s.t.) with straight ram air entry in nose of fuselage. Nose entry lipped above to maintain adequate air flow in nose-up position. Main fuel tanks in fuselage. External long-range drop-tanks may be carried under wings outboard of landing gear.

ACCOMMODATION.—Pressurised pilot's cockpit with sliding "bubble" canopy. Pilot ejection seat.

ARMAMENT.—Six 0.50-in. (12.7 mm.) machine-guns in nose. Provision for sixteen 5-in. (127 mm.) rockets under wings. May also carry 2 × 1,000-lb. or 2 × 2,000-lb. bombs in lieu of auxiliary tanks.

DIMENSIONS.—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

LOADED WEIGHT.—
16,500 lb. (7,490 kg.).

PERFORMANCE.—
Max. speed over 670 m.p.h. (1,072 km.h.).
Service ceiling: 53,000 ft. (16,170 m.).
Tactical radius: 535 miles (856 km.).
Normal cruise range: 1,250 miles (2,000 km.).
Ferry range with external tanks: 2,350 miles (3,760 km.).

THE NORTH AMERICAN FURY.
U.S. Navy designation: FJ.

The latest versions of the Fury are single-seat swept-wing carrier fighters developed from the F-86 Sabre. They have 35-degree swept wings and hydraulically-powered irreversible controls with artificial "feel" for the all-movable tail-unit, first introduced in the F-86E.

The landing-gear is similar to that of the Sabre but the nose-wheel unit is so designed that the normal nose-up static attitude can be increased for catapulting.

Extension of the nose-wheel shock strut is by hydraulic means and is achieved by a manually-controlled selector valve which is operated by the carrier deck crew. When the landing-gear is retracted after take-off hydraulic fluid returns to the reservoir. The extendable nose-wheel strut increases the angle between the thrust line and deck from 4 to 8 degrees.

Armament consists of four 20 mm. cannon and, on the later versions, two Philco Sidewinder air-to-air missiles. A Navy gun-sight and an improved Navy ejection-seat are fitted.

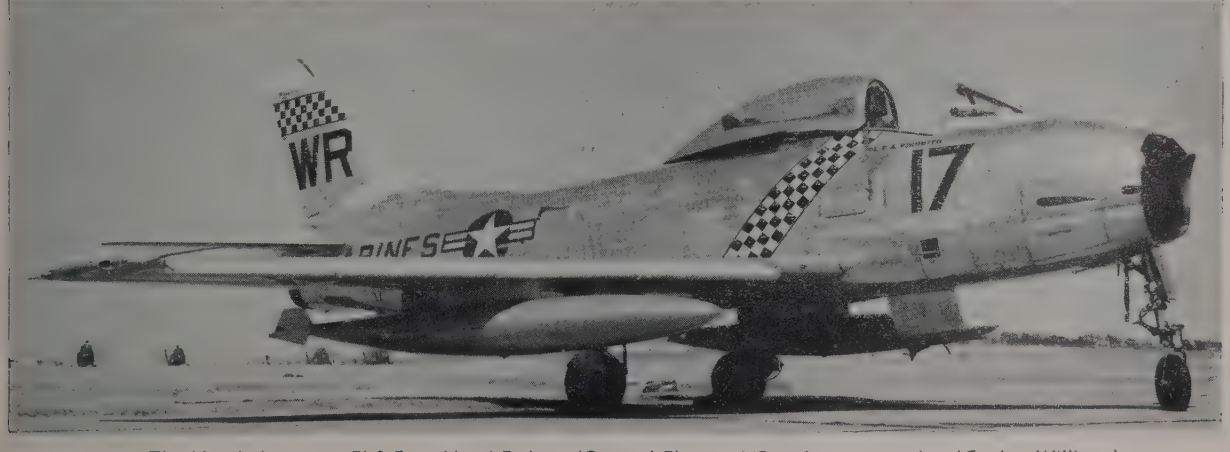
The following versions of the swept-wing Fury have been announced :—

FJ-2. General Electric J47-GE-2 engine (5,270 lb.=2,390 kg. s.t.). First production version. The prototype XFJ-2, which first flew on February 14, 1952, was a semi-navalised F-86E without folding wings or armament. The cannon armament was first installed in the XFJ-2B, which was otherwise a standard F-86E. Produced at Columbus, Ohio, and in service with the U.S. Marine Corps.

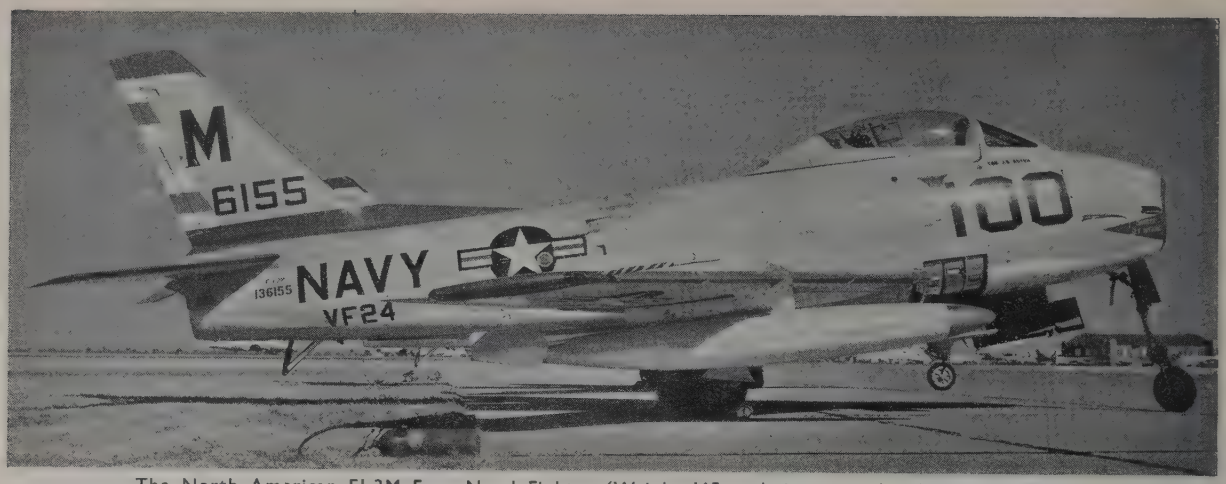
FJ-3. Wright J65-W-2 engine (7,200 lb.=3,270 kg. s.t.). Larger and slightly heavier version of FJ-2 with enhanced performance. Manufactured at Columbus, Ohio, and in service with U.S. Navy. XFJ-3 prototype flew for first time on July 3, 1953. A standard FJ-3 has climbed to 10,000 ft. (3,050 m.) from a standing start in 83 seconds.

FJ-4. Wright J65-W-4 engine (7,800 lb.=3,540 kg. s.t.). Improved version of FJ-3. First aircraft designed, developed and built by Columbus Division of N.A.A. New thin wing with mechanically-drooped leading-edge, slotted flaps and drooping split ailerons, new thinner-section all-moving tail, redesigned long-stroke landing gear, addition of dorsal spine from fin to cockpit. Can be equipped with "buddy" system of flight refuelling as described under entry for North American Super Sabre. First of two prototype FJ-4's flew on October 28, 1954, and first production model in March, 1955. The FJ-4 has been flight tested with a controllable auxiliary rocket-motor fitted to increase its operational ceiling.

FJ-4B. Attack fighter. Basically similar to FJ-4, with low altitude bombing



The North American FJ-2 Fury Naval Fighter (General Electric J47 turbojet engine). (*Gordon Williams*).



The North American FJ-3M Fury Naval Fighter (Wright J65 turbojet engine). (*Gordon Williams*).

system and control system improvements for high speeds at very low altitude. First FJ-4B flown on December 4, 1956.

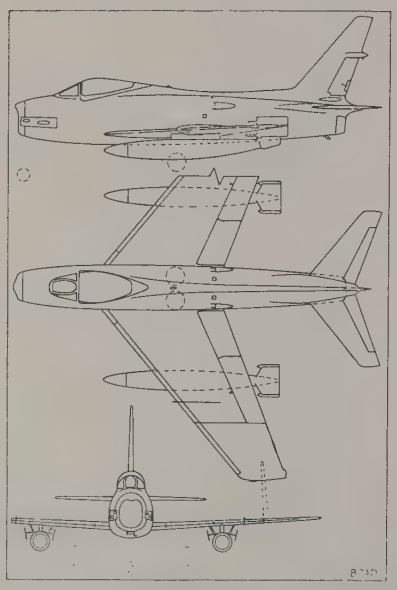
DIMENSIONS (FJ-3).—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 13 ft. 8 in. (4.16 m.).

DIMENSIONS (FJ-4).—
Span 39 ft. 1 in. (11.92 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 12 ft. 8 in. (3.86 m.).
Width folded 27 ft. 6 in. (8.38 m.).

WEIGHTS.—
Max. T.O. weight (FJ-3) over 18,000 lb. (8,170 kg.).
Max. T.O. weight (FJ-4) over 19,000 lb. (8,626 kg.).

PERFORMANCE (FJ-3).—
Max. speed 650 m.p.h. (1,050 km.h.).
Service ceiling 45,000 ft. (13,700 m.).
Combat range over 1,030 miles (1,650 km.).

PERFORMANCE (FJ-4).—
Max. speed over 690 m.p.h. (1,110 km.h.).
Service ceiling over 45,000 ft. (13,700 m.).



The North American FJ-4 Fury.

THE NORTH AMERICAN NAA-249.
U.S. Navy Designation: T2J-1.

After a design competition among several leading U.S. manufacturers, North American was awarded a contract in 1956 to develop a new jet training aircraft for the U.S. Navy. Designated T2J-1, this aircraft will be built in the company's Columbus Division.

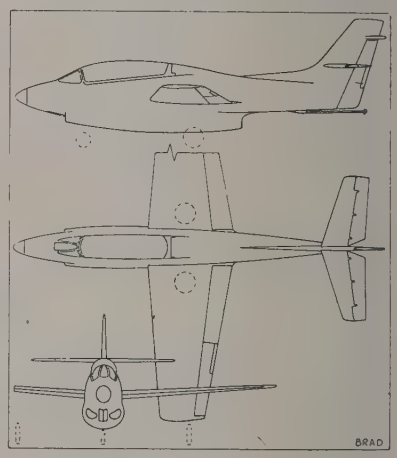
Designed for use throughout the complete syllabus of pilot training, from *ab initio* instruction to carrier indoctrination, the T2J-1 is in production in substantial quantity for the U.S. Navy. There is no prototype, and the first production T2J-1 was scheduled to fly before the end of 1957.

The standard T2J-1 is a tandem two-seater with a Westinghouse J34-WE-46 turbojet; but North American are offering an alternative version with a Bristol Orpheus turbojet. Emphasis is placed on the use of proven airframe components and power-plant, with off-the-shelf equipment. Thus the wing is basically similar to that of North American's original FJ-1 Fury jet fighter and the basic control system is that of the T-28C Trojan trainer, with an added hydraulic powered system.

TYPE.—Two-seat General-purpose Jet Trainer.

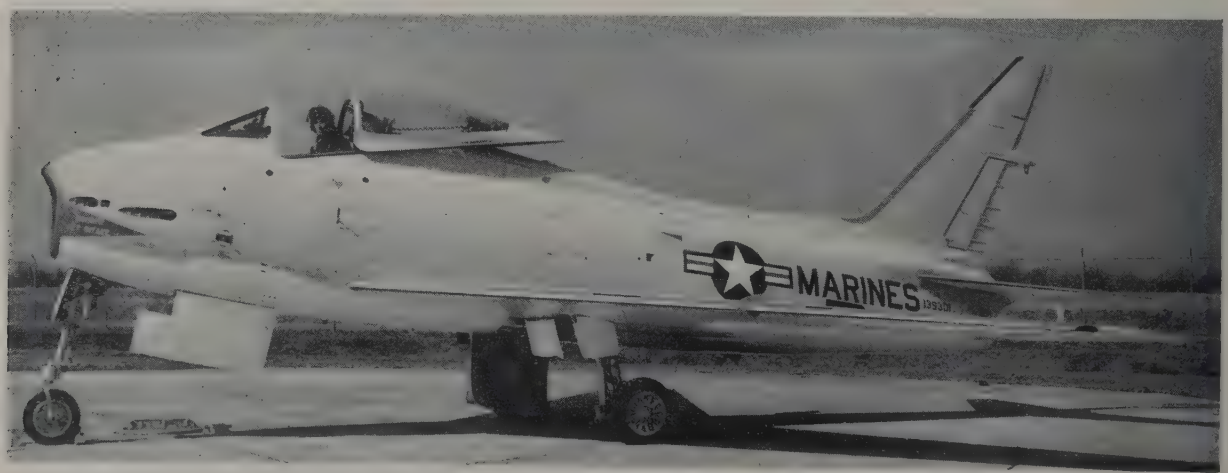
WINGS.—Mid-wing cantilever monoplane. Wing section NACA 64A212 (modified). Thickness/chord ratio 12%. All-metal two-spar structure. Interchangeable all-metal ailerons, with hydraulic boost. Large all-metal trailing-edge flaps. Total area of flaps 50 sq. ft. (4.65 m.²). Gross wing area 255 sq. ft. (23.69 m.²).

FUSELAGE.—All-metal semi-monocoque structure in three main sections: forward fuselage containing equipment bay and cockpit; centre fuselage housing power plant, fuel and wing carry-through structure; and rear fuselage, the undersurface of which has stainless steel skin in way of jet exhaust. Hydraulically-actuated air brake on each side of rear fuselage.



The North American T2J-1.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Each half of tailplane and elevators interchangeable. Elevators boosted hydraulically. Rudder manually controlled. Trim-tabs in elevators and rudder. Areas: fin 27.29 sq. ft. (2.54 m.²), rudder 10.71 sq. ft. (0.99 m.²), tailplane 50.34 sq. ft. (4.68 m.²), elevators 17.66 sq. ft. (1.64 m.²). Tailplane span 17 ft. 9 in. (5.40 m.).



The North American FJ-4 Fury Naval Fighter (Wright J65 turbojet engine).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Main units retract inward into wings. Nose-wheel retracts forward into fuselage. Retractable sting-type arrester hook. Wheel track 18 ft. 5 in. (5.62 m.).

POWER PLANT.—One Westinghouse J34-WE-46 turbojet engine (3,400 lb. = 1,540 kg. s.t.) with jet outlet under rear fuselage. Fuel in main tank over engine with capacity of 381 U.S. gallons (1,442 litres) and two wingtip tanks each of 100 U.S. gallons (379 litres). Total fuel capacity 581 U.S. gallons (2,200 litres).

ACCOMMODATION.—Pupil and instructor in tandem in enclosed cabin. Modified Martin-Baker ejection seats. Instructor is raised 10 in. (0.25 m.) above level of pupil and has closed-circuit transistorized TV gunnery instruction monitor to check pupil's accuracy of aim.

ARMAMENT.—Optional packaged installations of guns, target-towing gear, 100 lb. practice bombs, M-5 practice bomb clusters, Type T-1 practice bomb containers, 2.25 in. rocket launchers or 2.75 in. Mighty Mouse rocket packs.

DIMENSIONS.—
Span 36 ft. 0 in. (10.97 m.).
Length 38 ft. 9 in. (11.80 m.).
Height 14 ft. 0 in. (4.27 m.).

WEIGHT.—
Weight loaded 9,480 lb. (4,300 kg.).

PERFORMANCE (estimated).—
Max. speed 494 m.p.h. (795 km.h.).
Stalling speed 75 m.p.h. (120 km.h.).
Rate of climb at S/L. 5,000 ft./min. (1,500 m./min.).
Service ceiling 41,000 ft. (12,500 m.).
Take-off distance to 50 ft. (15.25 m.) 2,010 ft. (613 m.).
Landing distance from 50 ft. (15.25 m.) 1,690 ft. (515 m.).
Range 964 miles (1,550 km.).

THE NORTH AMERICAN T-28.

The T-28 was originally designed for the U.S.A.F. as a replacement for the T-6 and it went into production for the U.S.A.F. in 1950 as the T-28A.

In 1952, following the policy of standardisation of training aircraft for all the services, the T-28 was adopted by the U.S. Navy and in modified form was put into production under the designation T-28B and, later, as the T-28C.

The three T-28 versions differ in the following respects :—

T-28A. 800 h.p. Wright R-1300-1 seven-cylinder radial engine and Aero Products two-blade constant-speed airscrew. U.S.A.F. advanced trainer. Out of production in 1953.

T-28B. 1,425 h.p. Wright R-1820 engine driving a three-blade Hamilton Standard constant-speed airscrew. U.S. Navy advanced trainer structurally similar to T-28A. New cockpit canopy, which was also introduced in later production T-28A's. Air brake on lower surface of fuselage. All training armament external with gun mounts, rocket and bomb racks under wings. Gunsight and camera in front cockpit. Rearrangement of radio, electrical and oxygen equipment. Continues in production.



The North American T-28C Naval Trainer. (*Gordon Williams*).

T-28C Trojan. Same as T-28B but equipped with arrester hook, etc. for operation from aircraft-carriers. First T-28C flown on September 19, 1955.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure. Trailing-edge flap between ailerons and fuselage. Total flap area 53.6 sq. ft. (4.98 m.²). Gross wing area 268 sq. ft. (24.89 m.²).

FUSELAGE.—All - metal semi - monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Area of fin and rudder 30.3 sq. ft. (2.81 m.²), area of tailplane and elevators 59.7 sq. ft. (5.54 m.²).

LANDING GEAR.—Retractable tricycle type. Main wheels with Goodyear single-disc brakes retract inwardly into wings, nose-wheel backwards into fuselage. United Aircraft Products air-oil shock struts. Nose-wheel is steerable from either cockpit by electro-hydraulic boost control. Nose-wheel also carries a movable taxi light. Main wheel track 12 ft. 8 in. (3.86 m.).

POWER PLANT (T-28A).— One Wright R-1300-1 seven-cylinder radial air-cooled engine with a military and take-off rating of 800 h.p. and a normal rating of 700 h.p. Aero Products two-blade constant-speed airscrew 10 ft. (3.05 m.) diameter. Fuel capacity 125 U.S. gallons (473 litres).

POWER PLANT (T-28B).—One 1,425 h.p. Wright R-1820 engine driving a three-blade Hamilton Standard constant-speed airscrew, diameter 9 ft. 4 in. (2.84 m.).

ACCOMMODATION.—Tandem cockpits beneath single bubble canopy. Duplicated flight controls and instruments. Amber screen blind and night flying equipment with ultra-violet and infra-red instrument lighting.

ARMAMENT.—Provision for carrying bombs, 2.25 in. SCA rockets and .50 in. machine-guns.

DIMENSIONS (T-28C).—
Span 40 ft. 7 in. (12.37 m.).
Length 34 ft. 4 in. (10.45 m.).
Height overall 12 ft. 7 in. (3.84 m.).

WEIGHTS AND LOADINGS (T-28A).—
Weight empty 5,111 lb. (2,320 kg.).
Normal loaded weight 6,365 lb. (2,890 kg.).
Max. take-off weight 6,759 lb. (3,068 kg.).
Wing loading 23.8 lb./sq. ft. (116.14 kg./m.²).
Power loading 7.96 lb./h.p. (3.61 kg./h.p.).

WEIGHTS AND LOADINGS (T-28B).—
Weight empty 6,424 lb. (2,916 kg.).
Normal loaded weight 8,004 lb. (3,634 kg.).
Max. T.O. weight 8,486 lb. (3,853 kg.).
Normal wing loading 29 lb./sq. ft. (141.52 kg./m.²).
Normal power loading 5.6 lb./h.p. (2.54 kg./h.p.).

WEIGHT (T-28C).—
Max. take-off weight 8,247 lb. (3,741 kg.).

PERFORMANCE (T-28A).—
Max. speed 285 m.p.h. (456 km.h.) at 5,900 ft. (1,800 m.).
Cruising speed 190 m.p.h. (304 km.h).
Stalling speed 72 m.p.h. (115.2 km.h.).
Initial rate of climb 2,030 ft./min. (628 m./min.).
Service ceiling 29,000 ft. (8,845 m.).
T.O. run to clear 50 ft. (15.25 m.) 570 yds. (521 m.).
Max. range 1,008 miles (1,612 km.).

PERFORMANCE (T-28B).—
Max. speed 346 m.p.h. (554 km.h.).
Cruising speed 310 m.p.h. (496 km.h.) at 30,000 ft. (9,150 m.).
Initial rate of climb 3,830 ft./min. (1,168 m./min.).
Service ceiling 37,000 ft. (11,285 m.).
T.O. run to clear 50 ft. (15.25 m.) 380 yds. (348 m.).
Max. range 1,060 miles (1,696 km.) at 10,000 ft. (3,050 m.).

PERFORMANCE (T-28C).—
Max. speed approx. 346 m.p.h. (554 km.h.).
Service ceiling 35,000 ft. (10,670 m.).
Range over 860 miles (1,385 km.).

NORTHERN

NORTHERN AIRCRAFT, INC.

HEAD OFFICE AND WORKS: ALEXANDRIA, MINNESOTA.

Northern Aircraft purchased from the former Bellanca Aircraft Corporation all tools, dies, jigs, fixtures, plans and patents for the full rights to manufacture and distribute the Cruisemaster 14-19 four-seat touring aircraft. They have begun production of a new version, with a more powerful engine, the prototype of which flew on July 25, 1956, followed by the first production aircraft on October 11, 1956. All available details of this aircraft are given hereafter.

THE CRUISEMASTER 14-19-2.

TYPE.—Four-seat cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Aerofoil section Bellanca "B". Dihedral 4° 30'. Incidence 3° at tip. Wooden two-spar structure with plywood covering and fabric overall. Wooden ailerons and plain-hinge trailing-edge flaps, with fabric covering. Total area of ailerons 11.77 sq. ft. (1.09 m.²). Total area of flaps 16.16 sq. ft. (1.50 m.²). Wing area 161.5 sq. ft. (15.0 m.²).

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Wire-braced monoplane type with additional stabilising fins at extremities of tailplane. Welded steel-tube framework with fabric covering for all surfaces except auxiliary fins which have wooden structure. Trim-tab in port elevator. Areas : fin 5.67 sq. ft. (0.53 m.²), rudder 6.28 sq. ft. (0.58 m.²), elevators 12.20 sq. ft. (1.13 m.²), tailplane 17.21 sq. ft. (1.60 m.²), auxiliary fins (2) total 4.4 sq. ft. (0.41 m.²). Tailplane span 12 ft. 1½ in. (3.73 m.).

LANDING GEAR.—Tail-wheel type, with retractable main wheels and fixed tail-wheel. Hydraulic retraction. Wheels protrude slightly below wing when retracted, to reduce damage in a wheels-up landing. Hydraulic shock - absorbers. Firestone wheels and tyres. Firestone brakes. Track 8 ft. 10⅞ in. (2.71 m.).

POWER PLANT.—One 230 h.p. Continental O-470-K six-cylinder horizontally-opposed air-cooled engine. Hartzell or McCauley two-blade metal constant-speed airscrew. One 20 U.S. gallon (75.5 litres) tank in each wing, with 14 U.S. gallon (53 litres) auxiliary tank behind rear seat. Oil capacity 3 U.S. gallons (11.4 litres).

ACCOMMODATION.—Enclosed cabin seating four in two pairs. Compartment for 186 lb. (85 kg.) baggage, with outside door.



The Northern Cruisemaster (230 h.p. Continental O-470 engine).

DIMENSIONS.—
Span 34 ft. 2 in. (10.41 m.).
Length 22 ft. 10¾ in. (6.97 m.).
Height 6 ft. 2½ in. (1.89 m.).
WEIGHTS.—
Weight empty 1,640 lb. (744 kg.).
Weight loaded 2,700 lb. (1,225 kg.).
PERFORMANCE.—
Max. speed 206 m.p.h. (331 km.h.).
Cruising speed (75% power) 196 m.p.h. (315 km.h.).
Stalling speed 46 m.p.h. (74 km.h.).
Rate of climb at S/L 1,500 ft./min. (457 m./min.).
Service ceiling 20,000 ft. (6,100 m.).
Range 800 miles (1,285 km.).

NORTHROP

NORTHROP AIRCRAFT, INC.

HEAD OFFICE : BEVERLY HILLS, CALIFORNIA.

President : Whitley C. Collins.

Vice-President : Robert R. Miller.

Vice - President — Technical : Edgar Schmued.

Vice-President—Finance : Charles C. Cilley.

Vice - President — Corporate Development Planning : T. V. Jones.

Vice-President—Legal : William Larrabee.

Secretary : George Gore.

Assistant Secretary (Washington, D.C.) : S. W. Towle, Jr.

Assistant Secretary (Dayton, Ohio) : L. H. Coates.

Assistant to the President : Irving Roth.

A major reorganisation of Northrop's corporate structure took place on February 28, 1957, when the Board of Directors approved the creation of an overall corporate organisation designed to free top executives for broad planning, policy formulation and direction, and the first moves towards the establishment of company operations under a line division structure.

The former Northrop Aircraft Hawthorne operations, and related aircraft and missile facilities, are now established as the Northrop Division. A new division known as Northrop International has been established with responsibility for all overseas programmes of Northrop Aircraft, Inc. The third division is the Radioplane Company, whose activities are described separately in this section under "Radioplane."

NORTHROP DIVISION.

DIVISION HEAD OFFICE : HAWTHORNE, CALIFORNIA.

Vice-President and General Manager : Robert R. Miller.

Vice-President—Customer Relations : John R. Alison.

Vice-President—Manufacturing : Richard R. Nolan.

Vice-President—Administration : C. H. Miller.

Vice-President and Chief Engineer : Dr. William F. Ballhaus.

Treasurer : Dan H. Hill.

Northrop Aircraft, Inc. was formed in 1939 by John K. Northrop and others to undertake the design and manufacture of military aircraft.

During World War II, the company built 1,131 aircraft of its own design and was engaged in extensive sub-contract work. It also devoted considerable attention to the design and construction of "Flying Wing" type aircraft. Details of this work together with descriptions and illustrations of the various "Flying Wing" types built have appeared in previous editions of "All the World's Aircraft."

Northrop's major post-war production programme has been centred on the F-89 Scorpion, which was the first U.S.A.F. aircraft designed from the start as an all-weather interceptor. Production has now ended ; but existing Scorpions are being flown to the Northrop Palmdale factory for modification to the latest F-89J standard. This work will continue until 1958.

Under development for the U.S.A.F. is a supersonic jet trainer, the contract for which was announced in May, 1956, two years after Northrop started the design work as a private venture.

The company has also been working for seven years on boundary layer control systems, under the direction of Dr. Werner Pfenninger, and is flight testing a Martin B-57 modified to have a boundary layer suction sleeve fitted over one wing.

Northrop has been engaged in the research and development of guided missiles since 1946. The first American intercontinental guided missile to be unveiled by the U.S. Air Force was the Northrop SM-62 Snark, which has been tested successfully at the Missile Test Center in Florida and has been ordered into series production. Brief details and a photograph of the Snark will be found in the "Guided Missiles" Section. No details are available of the other types of guided missile under development by Northrop.

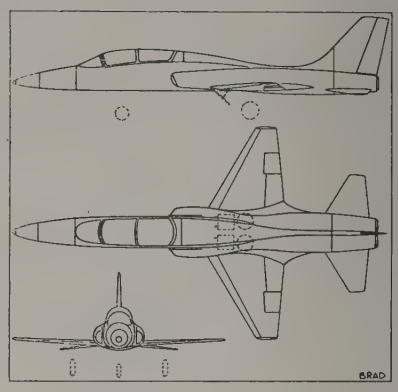
In addition to its main factory at Hawthorne, Northrop has many other facilities, including a flight test centre at Palmdale, California, and a branch factory at Anaheim, California, for production of optomechanical devices for the U.S. Ordnance Corps and aircraft and guided missile components for the U.S.A.F.

Purchasing, warehousing and allied activities are centred at a facility at El Segundo, California, and the company leased an additional administration block at Torrance, California, in October, 1956 to cope with the expanding Snark missile programme.

A new scientific research and development centre for work on guided missiles and advanced aircraft, and nuclear energy research, was scheduled for completion at Hawthorne during 1957.

THE NORTHROP T-38.

Developed for two years as a private venture, the T-38 is now being built as a supersonic lightweight twin-jet trainer for the U.S.A.F., under a contract awarded in May, 1956. The prototype is expected to fly in mid-1958, powered by two General Electric J85 or Fairchild J83 turbojets, and is intended to reproduce the flying characteristics of a supersonic operational fighter aircraft.



The Northrop T-38.

Intended as a replacement for the Lockheed T-33, the T-38 is an unswept mid-wing monoplane with the low-set "slab" tailplane associated with supersonic designs. Its fuselage is "waisted" in the region of the wing, in accordance with the area rule, and it seats two persons in tandem. The instructor's seat is raised to give him a forward view "over the shoulder" of the pupil. Special attention has also been paid to low initial and maintenance costs and the ability to operate from short runways.

No further details are available.

THE NORTHROP SCORPION.

U.S. Air Force designation: F-89.

The following are the principal versions of the F-89 Scorpion :—

F-89A. Two Allison J35-A-21 engines (4,900 lb.=2,225 kg. s.t. each) with afterburners. First production model. Armament consists of six nose-mounted 20 mm. cannon.

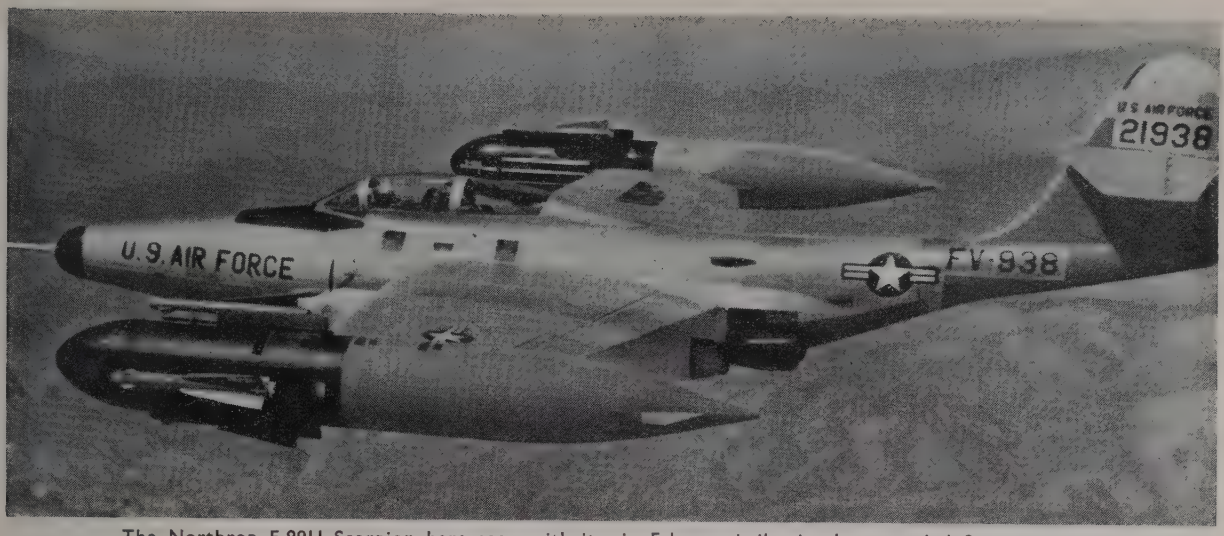
F-89B. Two Allison J35-A-33 engines (5,000 lb.=2,270 kg. s.t. each). Second production model. Generally similar to the F-89A but with certain internal and equipment changes.

F-89C. Two Allison J35-A-35 engines (5,600 lb.=2,540 kg. s.t. each). Progressive development of F-89B. External mass-balances on elevators suppressed.

F-89D. Two Allison J35-A-35 engines (5,600 lb.=2,540 kg. s.t. each) with Solar afterburners. Rocket-armament replaces the six 20 mm. nose-mounted cannon of earlier F-89 versions. A total of 104 2.75 in. folding-fin air-to-air rockets carried in permanently mounted wing-tip pods. Electronic aiming and automatic triggering equipment. Two droppable pylon-mounted underwing tanks equipped with Bohanan cartridge-type force ejectors



The Northrop F-89H Scorpion All-weather Fighter (two Allison J35 turbojet engines). (*Gordon Williams*).



The Northrop F-89H Scorpion here seen with its six Falcon missiles in the extended firing position.

for jettisoning. Additional fuel gives 11 per cent. increase in range as compared with F-89C.

XF-89E. Experimental aircraft serving as test-bed for Allison J71 engine.

F-89H. Followed F-89D in production. Armed with six Hughes GAR-1 Falcon air-to-air guided missiles, three in each wing-tip pod, and 42 × 2.75-in. rockets, 21 in each pod in clusters of seven behind frangible fairings. Can also carry MB-1 Genie air-to-air missile with nuclear warhead. Falcons and rockets can be fired selectively, the Falcons being extended clear of the pod on their launchers prior to firing. Automatic attack system includes sighting radar and fire control computer. Armament is triggered automatically. Maximum take-off weight over 40,000 lb. (18,145 kg.).

F-89J. This designation applies to earlier versions of F-89 brought up to F-89H standard under U.S.A.F. contract which will extend into 1958.

The following description refers to the F-89D.

TYPE.—Twin-engined two-seat All-weather Interceptor Fighter.

WINGS.—Low-wing cantilever monoplane. Thin-section high-lift low-drag wing-section. Thickness ratio 8½% at root, 7½% at tip. Taper ratio 2 : 1. Aspect ratio 4.5 : 1. Leading-edge sweep back 5°. All-metal multi-cellular structure. Double slotted flaps inboard of ailerons. The power-operated ailerons, or "decelerons," are split so as to serve as ailerons or dive-brakes. The upper and lower segments may be opened up and down simultaneously to serve as air brakes; or with the segments closed the surfaces operate as conventional ailerons. Hot-air anti-icing. Aileron area 45 sq. ft. (4.18 m.²). Flap area 63 sq. ft. (5.85 m.²). Gross wing area 562 sq. ft. (52.20 m.²).

FUSELAGE.—Oval section all-metal structure. Built in halves with joint along vertical centre-line, each half being equipped before assembly to central vertical keel which serves as mounting member for, and intervening firewall between, the two engines.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Power-operated control surfaces operated by aircraft hydraulic system, with emergency electrical actuation should hydraulic power fail. Tailplane span 11 ft. 6 in. (3.50 m.). Tailplane area 110 sq. ft. (10.22 m.²). Elevator area 25 sq. ft. (2.32 m.²). Vertical tail area (fin and rudder) 38 sq. ft. (3.53 m.²).

LANDING GEAR.—Retractable tricycle type. Main wheels are of large diameter and thin enough to permit total enclosure in wings when retracted. 165 lb./sq. in. tyre pressure. Hydraulic retraction.

POWER PLANT.—Two Allison J35 turbojet engines, each with a static (dry) thrust rating of 5,200 lb. (2,360 kg.). Solar afterburners with adjustable nozzles. Engines mounted one on each side of fore-and-aft fuselage keel low down and only partly within the fuselage contour. Engines may be lowered clear of mountings by built-in hydraulic hoist for ground level maintenance. Four lightweight Goodyear bullet-proof tanks in fuselage and twelve Goodyear Pliocel bladder tanks in wings. Underwing pylon-mounted auxiliary fuel tanks with Bohanan cartridge type jettison equipment.

ACCOMMODATION.—Crew of two, pilot and radar operator, in tandem in pressurised cockpit. Power-operated jettisonable canopy and ejection seats. Cabin heating and refrigeration.

ARMAMENT.—All-rocket armament. 104 × 2.75 in. folding-fin air-to-air rockets carried in two wing-tip pods. Electronic aiming and triggering equipment. Rockets may be fired in groups or in volley.

DIMENSIONS.—
Span 59 ft. 8 in. (18.19 m.).
Length 53 ft. 4 in. (16.26 m.).
Height 17 ft. 7 in. (5.36 m.).

WEIGHTS.—
Loaded weight over 40,000 lb. (18,160 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.).
Operational ceiling over 50,000 ft. (15,250 m.).
Range approx. 2,000 miles (3,200 km.).

THE NORTHROP SNARK.
U.S.A.F. designation: SM-62.

America's first intercontinental missile, the SM-62 Snark has a high-wing monoplane configuration, with sharply swept-back wings, a swept fin and rudder, but no horizontal tail surfaces. It is powered by a Pratt & Whitney J57 turbojet engine, which is supplemented at take-off by two large jettisonable booster rockets.

Intended to deliver a nuclear warhead over very long ranges, the Snark cruises at high altitude under guidance and makes its final dive into the target at near-sonic speed. It can be operated by day or night in all weathers, and is designed to be air transportable.

Following extensive and successful trials at the U.S.A.F.'s Missile Test Center, a large contract for the Snark was placed in the summer of 1957 and the production missile will be assigned to operational units of the U.S.A.F. Further details of the weapon are given in the "Guided Missiles" section of this work.

OMEGA
OMEGA AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: MUNICIPAL AIRPORT, NEW BEDFORD, MASSACHUSETTS.

President and Chief Designer: B. W. Sznycer.

Executive Vice-President: H. P. Whitney II.

Vice-President and Treasurer: R. J. T. du Pont.

Secretary: G. C. Fonda.

Omega Aircraft Corporation was formed in December, 1953, under the presidency of Mr. B. W. Sznycer, who had been responsible for the first certificated Canadian helicopter, the Sznycer-Gottlieb S.G. VI. Its first product, the Omega BS-12 Twin helicopter, flew for the first time on December 26, 1956, and is described hereafter.

THE OMEGA BS-12 TWIN.

The Omega BS-12 Twin is a twin-engined helicopter which was developed on paper through Mark 1 and 2 stages, with the object of producing a prototype that would be unusually easy to service and would perform satisfactorily from the start of its flight testing. This appears to have been achieved, because the BS-12 flew for the first time on December 26, 1956, only 1½ hours after its construction was completed and has since completed a great deal of successful development flying.

Two production versions are planned, as follows.

ES-12-SR. Commuter/cargo version with two 210 h.p. Franklin 6A-335-A engines.

ES-12-SC. Basically similar to BS-12-SR, but with two 225 h.p. Franklin 6A-355-A engines fitted with turbo-superchargers for operation at high altitudes.

TYPE.—Twin-engined General-purpose helicopter.

ROTOR SYSTEM.—One four-blade main rotor, built up of two separate two-blade fully-articulated rotors splined one above the other to rotor shaft. Friction damping. No planetary system. Two-blade tail anti-torque rotor.

ROTOR DRIVE.—Both engines connected to a single gear-box through a flexible drive, in which the first-stage spur gear reduction on each engine is replaced by a 13-belt drive. Nylon-cored full-wedge type rubber belts. Centrifugal clutch in drive shaft from each engine engages at 1,350 r.p.m. through action of flywheel-mounted brake linings. Spiral jaw clutch disengages engine from drive in case of failure. Final drive from belt to rotor shaft through spiral bevel gear.

FUSELAGE.—Semi-monocoque cabin structure, attached to parallel-section steel-tube fuselage structure which is uncovered to facilitate maintenance. Fuselage breaks down aft of main landing gear into two sections, by removal of four bolts, for transport and repair.

LANDING GEAR.—Four-wheel non-retractable type. Low-pressure oleo shock-absorbers with 12 in. (0.30 m.) travel. Struts for main gear designed also to support rear of cargo pannier, stretchers or other load carried under fuselage. Wheel track 12 ft. (3.66 m.).



The Omega BS-12 Twin General Purpose Helicopter (two 210 h.p. Franklin engines).

Power Plant (BS-12-SR).—Two Franklin 6A-335-A six-cylinder horizontally-opposed air-cooled engines, each developing 210 h.p. at 3,100 r.p.m. for take-off. Engines mounted on steel-tube outrigger structures and completely accessible for servicing. Complete power plants can be removed as units on their mountings. Duplicated fuel system.

Power Plant (BS-12-SC).—Two Franklin 6A-335-A six-cylinder horizontally-opposed air-cooled engines, fitted with turbo-superchargers and each developing 225 h.p. for take-off and 210 h.p. maximum cruise power at 10,000 ft. (3,050 m.). Otherwise as for BS-12-SR.

Accommodation.—Enclosed cabin for pilot and passenger side-by-side in front and with bench-type seat for two or three persons to the rear. Controls entirely manual. Rear seats removable to provide 36 cub. ft. (1.02 m.³) cargo space. Four stretchers, crop-spraying gear, or up to 1,000 lb. (455 kg.) of cargo in container or net can be carried under rear fuselage, directly under rotor drive-shaft.

Dimensions.—
Main rotor diameter 39 ft. 0 in. (11.88 m.).
Tail rotor diameter 7 ft. 3 in. (2.20 m.).
Fuselage length 38 ft. 6 in. (11.75 m.).
Height to top of rotor hub 13 ft. 0 in. (3.96 m.).

Weights (BS-12-SR).—
Weight empty 2,975 lb. (1,350 kg.).
Useful load 1,400 lb. (635 kg.).
Payload 1,000 lb. (455 kg.).
Weight loaded 4,375 lb. (1,985 kg.).

Weights (BS-12-SC).—
Weight empty 3,075 lb. (1,395 kg.).
Useful load 1,400 lb. (635 kg.).
Payload 1,000 lb. (455 kg.).
Weight loaded 4,550 lb. (2,064 kg.).

Performance (BS-12-SR).—
Max. speed at S/L. 103 m.p.h. (165 km.h.).
Cruising speed at S/L. (75% power) 88 m.p.h. (142 km.h.).
Rate of climb at S/L. 1,160 ft./min. (355 m./min.).
Hovering ceiling in ground effect 4,600 ft. (1,400 m.).
Service ceiling, 9,600 ft. (2,925 m.).
Endurance 1 hour.

Performance (BS-12-SC).—
Max. speed at S/L. 110 m.p.h. (177 km.h.).
Cruising speed at S/L. (75% power) 86 m.p.h. (138 km.h.).
Rate of climb at S/L. 1,200 ft./min. (365 m./min.).
Hovering ceiling in ground effect 9,600 ft. (2,925 m.).
Service ceiling 16,000 ft. (4,875 m.).
Endurance 1 hour 15 min.



A front view of the Omega BS-12 Twin Helicopter.

ON MARK

ON MARK ENGINEERING COMPANY.

Head Office and Works : 7,929 Hayvenhurst Avenue, Van Nuys Airport, Van Nuys, California.

Aircraft Coupling Division : 200, Avenue 64, Los Angeles 42, California.

President : Robert O. Denny.

Vice-Presidents : L. A. Keithley and W. H. Doheny.

Chief Engineer : Floyd Snow.

Secretary-Treasurer : Roy A. Wood.

This company was formed in 1954, when Mr. R. O. Denny and Mr. L. A. Keithley resigned from their former positions as President and Operations Manager respectively of Grand Central Aircraft Co. to start their own business. Since then, On Mark has outgrown two factories and is already planning for expansion of its newly-opened facilities at Van Nuys Airport.

Main work of On Mark since its formation has been modification, repair and overhaul of Douglas B-26 aircraft. This has included the complete re-manufacture of B-26 airframes to convert them into high-speed civilian executive transports. In addition, On Mark is the exclusive licensee of Douglas Aircraft Company, Inc., in the production of spare parts for the B-26, and holds U.S.A.F. contracts for overhauling components such as hydraulic units, control surfaces and exhaust systems.

Now the company is building the prototype of a twin-turboprop pressurised executive transport of its own design, known as the Model 450 Marksman, and is planning to produce it at the rate of two aircraft per month by 1959. A description of this aircraft is given hereafter.

THE ON MARK 450 MARKSMAN.

Type.—Twin-engined Executive Transport.

Wings.—Cantilever mid-wing monoplane. NACA 65,2-215 wing section. Aspect ratio 9.725. Chord 11 ft. 0.5 in. (3.36 m.) at root, 4 ft. 10 in. (1.47 m.) at tip. Dihedral 4.5°. Incidence 2°. Two-spar duralumin structure. Duralumin ailerons and flaps. Total area of ailerons 38.83 sq. ft. (3.61 m.²). Total area of flaps 83.1 sq. ft. (7.72 m.²). Gross wing area 590.4 sq. ft. (54.85 m.²).

Fuselage. — Semi - monocoque duralumin structure of circular section.

Tail Unit.—Cantilever monoplane type. All-metal structure of duralumin. Areas : fin 54.7 sq. ft. (5.08 m.²), rudder 34.5 sq. ft. (3.21 m.²), elevators 43.0 sq. ft. (3.99 m.²), tailplane 87.2 sq. ft. (8.10 m.²). Tailplane span 26 ft. 6 in. (8.08 m.).

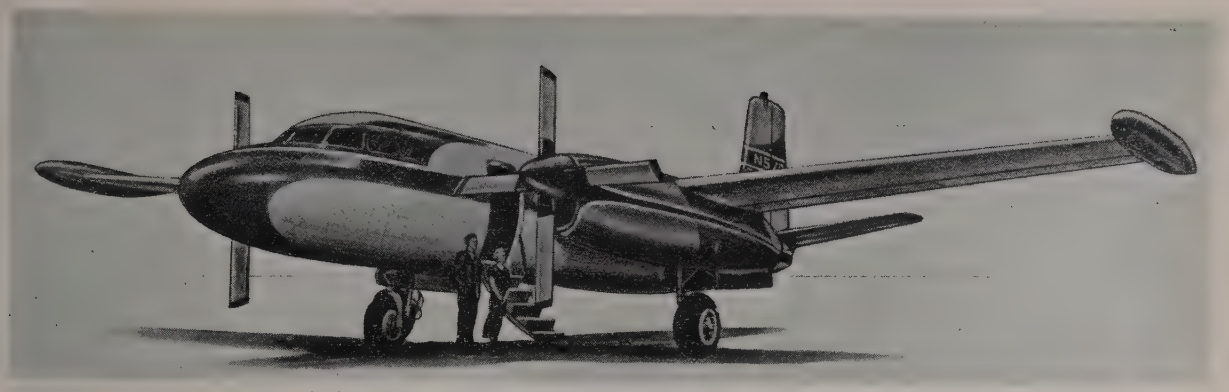
Landing Gear.—Retractable tricycle type. Hydraulic retraction. Aerol-Cleveland pneumatic shock-absorbers. Goodyear wheels and disc brakes. Wheel track 23 ft. 10¾ in. (7.28 m.). Wheelbase 17 ft. 9 in. (5.40 m.).

Power Plant.—Two 3,750-4,000 h.p. Allison 501-D13/D15 turboprop engines, driving Aeroproducts Model A6441 FN-606 four-blade fully-feathering, reversible-pitch airscrews. Fuel contained in integral tanks between wing spars with total capacity of 1,585 U.S. gallons (6,000 litres), and two wing-tip tanks with total capacity of 500 U.S. gallons (1,890 litres). Oil capacity 30 U.S. gallons (114 litres).

Accommodation.—Crew of two and up to 14 passengers in a cabin designed to customer's own specification. Cabin pressurised to equivalent of S/L. at 20,000 ft. (6,100 m.) or of 5,000 ft. (1,525 m.) at 30,000 ft. (9,150 m.).

Dimensions.—
Span 74 ft. 5½ in. (22.7 m.).
Length 64 ft. 8½ in. (19.70 m.).
Height 22 ft. 1 in. (6.73 m.).

Weights.—
Weight empty 23,000 lb. (10,433 kg.).
Weight loaded 40,000 lb. (18,144 kg.).
Landing weight 33,000 lb. (14,969 kg.).



A drawing of the On Mark 450 Marksman Executive Transport.

PERFORMANCE (at 38,000 lb.=17,237 kg. A.U.W., estimated).—
Cruising speed at 30,000 ft. (9,150 m.) 422 m.p.h. (679 km.h.).
Rate of climb at 5,000 ft. (1,525 m.) 3,220 ft./min. (980 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 1,735 ft./min. (530 m./min.).
Rate of climb on one engine at 5,000 ft. (1,525 m.) 880 ft./min. (270 m./min.).
Ceiling 34,700 ft. (10,575 m.).
Take-off distance to 50 ft. (15.25 m.) at max. A.U.W. 4,170 ft. (1,270 m.).
Landing distance from 50 ft. (15.25 m.) at landing weight, with anti-skid brakes and reverse-pitch 2,200 ft. (670 m.).
Max. range 3,100 miles (4,990 km.).

THE ON MARK EXECUTIVE.

The On Mark Executive is a completely remanufactured Douglas B-26 bomber, powered by two Pratt & Whitney R-2800-75/79 or R-2800-CB 16 engines and furnished luxuriously to the customer's specification. It carries a useful load of 12,000 lb. (5,443 kg.), which can include up to 11 passengers, a crew of two, an internal fuel load of 1,235 U.S. gallons (4,673 litres) and up to 3,500 lb. (1,588 kg.) of baggage and freight. Wing-tip fuel tanks, each with a capacity of 165 U.S. gallons (622 litres), are available for increased ranges of up to 2,700 miles (4,345 km.).

A description of the basic B-26 airframe has appeared in previous editions of "All the World's Aircraft." On Mark modifications in the executive version include the fitting of double-glass cabin windows, sound-proofing and insulation, a hydraulically-operated self-contained entrance stairway under the fuselage or on starboard side of cabin, a baggage compartment in the nose, disc brakes, dual controls and full instrumentation and radio. Reversible-pitch airscrews are available, if specified.

PERFORMANCE.—
Cruising speed (R-2800-CB16 engines, 62% power) 365 m.p.h. (587 km.h.).
Cruising speed (R-2800-75/79 engines, 62% power) 315 m.p.h. (507 km.h.).
Normal range over 2,100 miles (3,380 km.).
Max. range 2,700 miles (4,345 km.).

PIASECKI

PIASECKI AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: INTERNATIONAL AIRPORT, PHILADELPHIA, PA. DELAWARE DIVISION: BELLANCA AIRPORT, NEW CASTLE, DELAWARE.
President: Frank N. Piasecki.
Chief of Design: Zbyslaw Ciolkosz.

The Piasecki Aircraft Corporation was formed in 1955 by Mr. Frank Piasecki, who was formerly Chairman of the Board and President of the Piasecki Helicopter Corporation (now renamed Vertol Aircraft Corporation, which see).

In November, 1956, the new Piasecki Aircraft Corporation expanded its facilities by acquiring the 330-acre plant, machinery and other physical assets of the Aircraft Division of the Bellanca Corporation. This plant will be operated as Piasecki's Delaware Division.

The Piasecki company is engaged in all phases of vertical lift research and development, and at the time of writing held twelve prime contracts from the U.S. Army and Navy, of which seven were secret.

The contracts include one from the Navy to design, ground test and wind tunnel test a new type of vertical lift aircraft which combines the versatility of the helicopter with the capabilities of high level-flight speeds. Covered by the designation of PA-2C, this aircraft is being designed primarily for operation from aircraft carriers, cruisers, destroyers and unprepared land areas, but has civilian applications. No details are available except that it takes off in a horizontal attitude, can hover and fly backwards, is multi-engined and would fly, glide and land safely under full control with one engine out or after a complete power plant failure.

Another Naval contract is for the design and construction of an unmanned, remotely-controlled vertical lift aircraft known as the PA-4A "Sea Bat." Small enough to be operated from restricted areas on small warships and to be stowed on board submarines, the "Sea Bat" is intended to be operated under electronic control on duties that would be difficult or impossible to carry out without high probability of serious loss to conventional fixed-wing aircraft or helicopters and their crews. It will be able to hover and fly quickly in any direction.

Piasecki is working on advanced designs of "flying crane" helicopters under contract from the U.S. Army's Transportation Corps' Research and Development Command. Aim of this programme is to produce a heavy lift design capable of carrying up to 16 tons of cargo for distances up to 100 miles (160 km.).

In addition, the company has a Transportation Corps contract to design, manufacture and flight test a radically-new low-vibration, low-maintenance helicopter rotor that will greatly reduce the initial and operating costs of rotating-wing aircraft. Intended specifically to replace the existing rotors of the Vertol H-25 helicopter, but applicable to other types, the new design eliminates many parts in the present assembly of rotor blades and their attachment to the drive shaft and 80% of the bearings in the present hinge-assembly.

Only other contract that can be mentioned is for engineering research on a minesweeping system for the U.S. Navy.

PIPER

THE PIPER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: LOCK HAVEN, PENNSYLVANIA.
President and Chairman of the Board: W. T. Piper, Sr.
Executive Vice-President: W. T. Piper, Jr.
Vice-President in charge of Operations: Thomas F. Piper.
Vice-President in charge of Research and Development: Howard Piper.
Chief Engineer: W. C. Jamouneau.

The Piper Aircraft Corporation is now manufacturing the PA-42 Comanche, a four-seat single-engined high-performance executive aircraft; the PA-23 Apache, a twin-engined executive aircraft for four passengers; the PA-22 Tri-Pacer; the Super Cub; and the PA-18-A agricultural version of the Super Cub 150.

The entirely-new Piper Comanche four-seat executive low-wing monoplane made its first flight on May 24, 1956, and first deliveries were scheduled for the Autumn of 1957.

In August, 1957, Piper delivered its 45,000th aircraft. This total, which included over 1,000 twin-engined Apaches and 5,000 Tri-Pacers, was claimed to be the greatest number of civil-type aircraft delivered by any manufacturer in the World.

At about the same time, the new Piper Aircraft Development Center at Vero Beach, Florida, was scheduled to come into full operation. It will handle the design, construction and test flying of experimental prototypes of future Piper aircraft, and one of the first types sent there for evaluation was the Piper-sponsored Ag-3 agricultural aircraft built at the Texas A. and M. College.

Sub-contracting activities include considerable work for both jet aircraft and helicopter manufacturers.

Piper Aircraft Corporation still leads in World sales of light aircraft.

THE PIPER PA-42 COMANCHE.

Of conventional low-wing monoplane design, the Comanche is an all-metal four-seat high-performance executive aircraft, the general external characteristics of which are shown in the accompanying photograph. Special features of this aircraft include a laminar-flow wing, swept fin and rudder and a single-unit "flying tail."

The prototype, which flew for the first time on May 24, 1956, was powered by a 180 h.p. Lycoming O-360 engine, and this power-unit is fitted to the first production model, deliveries of which were due to begin in the Autumn of 1957. A second version to be powered by a 250 h.p. Lycoming engine was scheduled for development in 1957.

The Comanche received its C.A.A. certification on June 20, 1957.

At the time of writing no structural or performance details had been released by the manufacturers.

THE PIPER PA-23 APACHE.

TYPE.—Four/five-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. U.S.A. 35-B (modified) wing section. Aspect ratio 6.8. Chord 5 ft. 7 in. (1.70 m.). Dihedral 5°. All-metal structure. Frise type all-metal ailerons and flaps. Total aileron area 8.375 sq. ft. (0.77 m.²). Gross wing area 204 sq. ft. (18.95 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal. Areas: fin 10.75 sq. ft. (1.00 m.²), rudder 9.75 sq. ft. (0.90 m.²), elevators (total) 16.6 sq. ft. (1.54 m.²), tailplane 23.6 sq. ft. (2.19 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction, with emergency pneumatic operation. Electrol hydraulic shock-absorber struts. Goodrich wheels. Hydraulic brakes. Wheelbase 7 ft. 6 in. (2.28 m.). Track 11 ft. (3.35 m.).

POWER PLANT.—Two 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engines. Hartzell two-blade constant-speed full-feathering airscrews, 6 ft. 4 in. (1.93 m.) diameter. Two rubber-cell fuel tanks, one in each wing. Total normal fuel capacity 72 U.S. gallons (272 litres). Two additional tanks (18 U.S. gallons=68 litres each) can be installed outboard of standard wing tanks.

ACCOMMODATION.—Enclosed cabin with standard seating for four in two pairs, with dual controls to front pair. Cabin can be readily adapted for the fitting of an extra seat at rear of cabin. Normal capacity for 12½ cub. ft. (0.35 m.³) baggage. Full



The Piper PA-23 Apache (two 150 h.p. Lycoming O-320 engines).

instrumentation and sound-proofing. Omni radio, VHF, LF and automatic D/R equipment.

DIMENSIONS.—
Span 37 ft. 1⅜ in. (11.32 m.).
Length 27 ft. 4⅞ in. (8.34 m.).
Height 9 ft. 6 in. (2.87 m.).

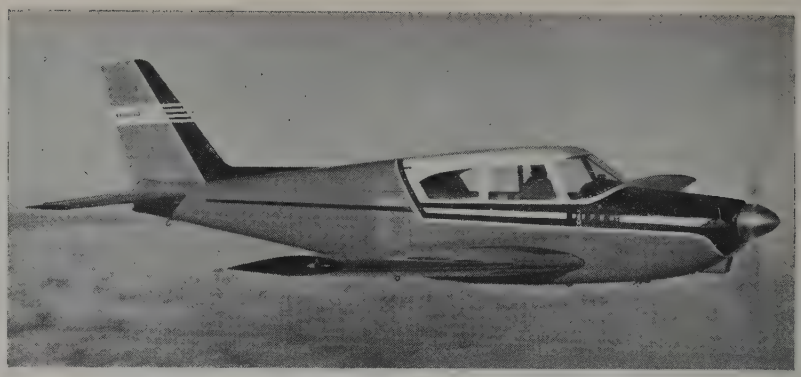
WEIGHTS AND LOADINGS.—
Weight empty 2,180 lb. (990 kg.).
Passengers (4) 680 lb. (309 kg.).
Fuel and oil 462 lb. (210 kg.).
Baggage allowable 200 lb. (91 kg.).
Weight loaded 3,500 lb. (1,590 kg.).
Wing loading 17.2 lb./sq. ft. (83.94 kg./m.²).
Power loading 11.6 lb./h.p. (5.26 kg./h.p.).

PERFORMANCE.—
Max. speed 180 m.p.h. (288 km.h.).
Cruising speed at 6,000 ft. (1,830 m.) 170 m.p.h. (272 km.h.).
Stalling speed (wheels and flaps down) 52 m.p.h. (83 km.h.).
Initial rate of climb 1,350 ft./min. (412 m./min.).
Rate of climb on one engine 240 ft./min. (93 m./min.).
Absolute ceiling 20,000 ft. (6,100 m.).
Single-engine ceiling 6,750 ft. (2,060 m.).
Cruising range 840 miles (1,345 km.).
Max. range with additional fuel tanks 1,200 miles (1,930 km.).
Take-off run 900 ft. (275 m.).
Landing run 670 ft. (204 m.).

THE PIPER PA-22 TRI-PACER.

TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing braced monoplane. Wing section US-35B (modified). Chord 5 ft. 3 in. (1.60 m.). Wing structure consists of two I-section aluminium spars, riveted Nicral ribs and a covering of Duroclad, a non-inflammable Butyrate-plastic-treated fabric of high-gloss finish. Flaps inboard of ailerons. Wing area 147.5 sq. ft. (13.7 m.²).



The Piper PA-42 Comanche (180 h.p. Lycoming O-360 engine).

FUSELAGE.—Rectangular welded steel-tube structure covered with Duroclad.

TAIL UNIT.—Braced monoplane type. Same structure as for PA-18.

LANDING GEAR.—Fixed nose-wheel type. Two side Vees and half axles hinged to centre-line of underside of fuselage. Hydrasorb shock-absorbers. Hydraulic wheel brakes. Steerable nose-wheel interconnected with rudder for ground steering. Certified for floats and skis.

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Two-blade Aeromatic or Sensenich metal fixed-pitch airscrew, diameter 6 ft. 4 in. (1.93 m.). Fuel capacity 36 U.S. gallons (136 litres). Additional 8 U.S. gallon (30 litres) auxiliary tank optional.

ACCOMMODATION.—Cabin seats four in two pairs with dual controls to front pair. Front and rear doors, front door on starboard side and rear door on port side. Soundproofing, cabin heating and temperature control. Ultra-violet-absorbing Plexiglas windows. Compartment for 100 lb. (45 kg.) baggage. Cabin equipment varies according to model. Narco two-way VHF and LF radio or automatic direction-finding and omni equipment in Custom model.

DIMENSIONS.—
Span 29 ft. 3⅛ in. (8.9 m.).
Length 20 ft. 8⅞ in. (6.32 m.).
Height 8 ft. 4 in. (2.54 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,100 lb. (500 kg.).
Disposable load 900 lb. (408 kg.).
Weight loaded 2,000 lb. (908 kg.).
Wing loading 13.5 lb./sq. ft. (65.88 kg./m.²).
Power loading 13.3 lb./h.p. (6.03 kg./h.p.).

PERFORMANCE.—
Max. speed 139 m.p.h. (222 km.h.).
Cruising speed (75% power at S/L.) 123 m.p.h. (197 km.h.).
Optimum cruising speed (75% power at 7,000 ft.=2,135 m.) 132 m.p.h. (211 km.h.).
Stalling speed (flaps extended) 49 m.p.h. (78.4 km.h.).
Rate of climb at S/L. 725 ft./min. (221 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Absolute ceiling 17,500 ft. (5,340 m.).
Range with normal tankage over 500 miles (800 km.).
Max. range with auxiliary tank over 600 miles (960 km.).

THE PIPER PA-18 SUPER CUB "150".

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing braced monoplane. Wing structure of aluminium spars and aluminium-alloy ribs, the whole being covered with Duroclad. Steel-tube Vee bracing struts. Wing flaps. Gross wing area 178.5 sq. ft. (16.58 m.²).

FUSELAGE.—Rectangular welded steel-tube structure covered with Duroclad.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework covered with Duroclad. Tailplane span 10 ft. 6 in. (3.20 m.).

LANDING GEAR.—Fixed divided type. Two side Vees and half axles hinged to cabane below fuselage. Rubber cord shock absorption. Hydraulic wheel-brakes. Leaf-spring steerable tail-wheel. Edo standard or amphibious floats may be fitted.

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine on swinging engine mounting. Two-blade wood or metal airscrew. Fuel capacity 36 U.S. gallons (136 litres).

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Large door on right side and sliding windows on left. Baggage compartment aft of rear seat. Equipment may be installed for spraying, dusting, fertilising, etc.

DIMENSIONS.—
Span 35 ft. 2½ in. (10.72 m.).
Length 22 ft. 6 in. (6.86 m.).
Height 6 ft. 7 in. (2.00 m.).



The Piper PA-22 Tri-Pacer (150 h.p. Lycoming O-320 engine).

WEIGHTS AND LOADINGS.—
Weight empty 930 lb. (422 kg.).
Disposable load 820 lb. (372 kg.).
Weight loaded 1,750 lb. (794 kg.).
Wing loading 10 lb./sq. ft. (48.8 kg./m.²).
Power loading 11.6 lb./h.p. (5.26 kg./h.p.).
PERFORMANCE.—
Max. speed 130 m.p.h. (208 km.h.).
Cruising speed (75% power) 115 m.p.h. (184 km.h.).
Stalling speed (with flaps) 43 m.p.h. (68.8 km.h.).
Best rate of climb 725 ft./min. (220 m./min.).
Service ceiling 19,000 ft. (5,795 m.).
Take-off run 200 ft. (61 m.).
Take-off distance to 50 ft. (15.25 m.) 500 ft. (152.5 m.).
Landing run 350 ft. (107 m.).
Cruising range 460 miles (735 km.).

THE PIPER PA-18 SUPER CUB "95".

The Super Cub "95" is identical to the "150" except that it is powered by the 90 h.p. Continental C90 engine and is not fitted with wing flaps.

DIMENSIONS.—
Same as for Super Cub "150" except :—
Length 22 ft. 4½ in. (6.82 m.).
WEIGHTS AND LOADINGS.—
Weight empty 800 lb. (363 kg.).
Disposable load 700 lb. (317 kg.).
Weight loaded 1,500 lb. (680 kg.).
Wing loading 8.4 lb./sq. ft. (50 kg./m.²).
Power loading 16.6 lb./h.p. (7.53 kg./h.p.).
PERFORMANCE.—
Max. speed 110 m.p.h. (176 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed 42 m.p.h. (67.2 km.h.).
Rate of climb at S/L. 624 ft./min. (190 m./min.).
Service ceiling 13,500 ft. (4,120 m.).
T.O. run 452 ft. (138 m.).
T.O. to clear 50 ft. (15.25 m.) 952 ft. (290 m.).
Landing run 385 ft. (117 m.).

THE PIPER PA-18-A.

This version of the Super Cub is primarily an agricultural sprayer/duster, but it is adaptable for normal uses. It is quantity produced with Piper designed and installed agricultural dispersal equipment as an integral part of the aircraft.



The Piper PA-18 Super Cub "150" (150 h.p. Lycoming O-320 engine).

The fuselage has been modified to accommodate an 18 cub. ft. aluminium tank which has a capacity for 110 U.S. gallons of liquid or from 500 to 1,000 lb. of solids, depending on the specific gravity of material used. Every unit has a maximum output of 35 gallons per minute and a pressure range of from 10 to 110 lb., depending on the nozzle orifice and pressure regulator setting.

For dust distribution, an agitator in the hopper and, below the fuselage, a slotted venturi with double gates and lateral dispersal plates ensure uniform flow over a 50 ft. swath.

The normal spray booms are fitted with 24 diaphragm type nozzles which give instant positive shut-off. The booms are hinged to fold back and up about 80° to reduce impact loads if they hit an obstacle.

A new Piper high-density sprayer is also available which will permit the application of from 1 to 10 gallons per acre for a full 50 ft. swath, or 10 to 15 gallons if the swath is cut to 33 ft. This equipment incorporates 46 nozzles on the boom, a new large Simplex pump mounted under the nose cowling and larger outlet and return pipes from the tank to the pump. This high-density unit was designed primarily for de-foliating irrigated cotton and now has many new uses.

Safety features include sharpened leading-edges on the landing-gear struts to cut wires, etc., heavy duty safety belt and shoulder harness for the pilot, etc.

The 1957 PA-18-A is powered by the 150 h.p. Lycoming O-320 engine.

DIMENSIONS.—Same as for Super Cub.
WEIGHTS AND LOADINGS (Sprayer or Duster).—
Weight empty 960 lb. (436 kg.).
Disposable load 1,110 lb. (504 kg.).
Weight loaded (max. permissible) 2,070 lb. (940 kg.).
Wing loading 11.6 lb./sq. ft. (56.6 kg./m.²).
Power loading 13.8 lb./h.p. (6.62 kg./h.p.).
PERFORMANCE (at 2,070 lb. = 940 kg. A.U.W.).—
Max. speed 128 m.p.h. (205 km.h.).
Cruising speed (75% power) 113 m.p.h. (181 km.h.).
Stalling speed (flaps down) 45 m.p.h. (72 km.h.).
Rate of climb 760 ft./min. (232 m./min.).
Service ceiling 17,000 ft. (5,185 m.).
Take-off distance to 50 ft. (15.25 m.) 950 ft. (290 m.).
Landing distance from 50 ft. (15.25 m.) 875 ft. (267 m.).



The Piper PA-18-A Agricultural Duster and Sprayer.

RADIOPLANE

RADIOPLANE DIVISION, NORTHROP AIRCRAFT, INC.

HEAD OFFICE: 8000, WOODLEY AVENUE, VAN NUYS, CALIFORNIA.
OTHER WORKS : EL PASO, TEXAS.
President : Whitley C. Collins.
Executive Vice-President : William Larrabee.
Vice-President, General Manager : M. W. Tuttle.
Vice-President, Administration : H. E. Riggins, Jr.
Vice-President, Customer Relations : F. Crank.
Vice-President, Engineering : S. E. Weaver.
Vice-President, Manufacturing : P. I. Chase.
Assistant Vice-President, Military Relations : A. W. Callam.
Assistant Vice-President, Weapons Systems Division Engineering : William Patterson.
Assistant Vice-President, Drone Systems Division Engineering : John R. Jacobsen.
Secretary-Treasurer : Joseph Corie.

The Radioplane Division of Northrop Aircraft Inc., designs and manufactures missiles, pilotless target aircraft and related equipment, such as catapults and other ground support gear.

The Radioplane Division undertook the design, development and construction of its first radio-controlled aircraft target nineteen years ago. Since then the company has expanded to become a leader in the field of pilotless aircraft. Over 40,000 Radioplane target drones have been delivered to the U.S. military services and the company has also been awarded a major contract to provide target flight service for U.S. Army surface-to-air missile training at Fort Bliss, Texas. The contract requires not only provision of targets and ground support gear, but operational, training and maintenance personnel as well.

Beginning in 1935, a series of experimental drones was developed and the first production model (OQ-2A) was delivered in that year. The OQ-2A had a 6½ h.p. engine and cruised at 88 m.p.h. (141 km.h.). The current Radioplane target drone, the OQ-19, has a 72 h.p. engine, a level flight speed of 227 m.p.h. (363 km.h.) and is capable of climbing 2,400 ft./min. (730 m./min.) to a service ceiling of 23,000 ft. (7,010 m.).

Deliveries of the new rocket-powered XKD4R-1 target drones have been made to the U.S. Navy's Air Missile Test Center at Point Mugu, California, for evaluation as air-to-air fleet training targets.

In addition to target drone work, Radioplane is participating in classified research and development programmes for the U.S.A.F. and U.S. Navy. Under U.S.A.F. contract is the development of the Crossbow missile system and the supersonic XQ-4 turbojet-powered target drone which will be used to evaluate weapon systems.

Since 1943 Radioplane has been engaged in research and development on parachute deceleration and recovery problems, and in the design, development and manufacture of missile recovery systems.

THE RADIOPLANE XQ-4 DRONE.

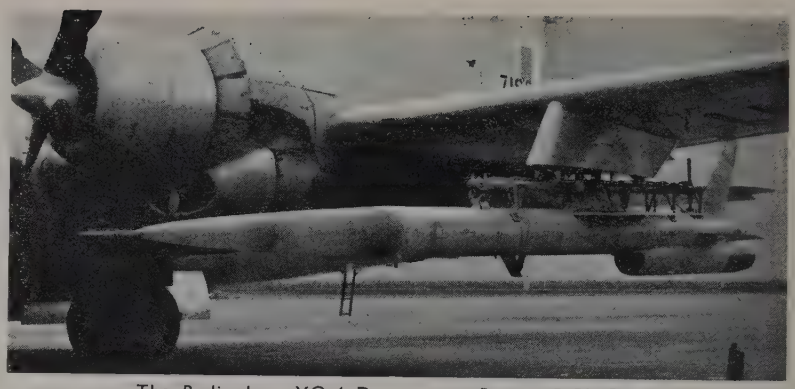
Designed to exceed considerably the performance of all currently-operational target drones, the radar-controlled XQ-4

has a very long small-diameter fuselage, short straight wings and an underslung Westinghouse J81 turbojet engine. Capable of supersonic speeds, it can be launched either from the ground or from an aircraft in flight, and is recoverable by a three-stage parachute.

Several highly successful test flights of the XQ-4 have been made at Holloman Air Force Base, New Mexico, and large production orders for it were announced in July, 1957. Production XQ-4 drones will be used as targets to evaluate both piloted aircraft and guided missile weapon systems. Their payload will be sufficient to accommodate special tracking, scoring and photographic or television reconnaissance installations.

DIMENSIONS (approx.).—
Span 12 ft. (3.66 m.).
Length 35 ft. (10.67 m.).
Diameter of fuselage 2 ft. (0.61 m.).

PERFORMANCE.—
Ceiling over 60,000 ft. (18,290 m.).



The Radioplane XQ-4 Drone on a Boeing B-50 Carrier.

THE RADIOPLANE RP-70 DRONE.

U.S. Navy designation: XKD4R-1.

Now under evaluation by the U.S. Navy as the XKD4R-1, the Radioplane RP-70 drone is intended to provide target practice for air-to-air missiles and is capable of Mach 0.9 at 50,000 ft. (15,250 m.). It is powered by a solid-propellent rocket which exhausts through dual nozzles in the sides of the fuselage just aft of the wings, and has an endurance of 8-10 minutes.

The airframe, which weighs 300 lb. (136 kg.), is designed for high volume production. With the exception of the steel rocket motor case, which forms the mid section of the fuselage, all other primary structures are of glass-fibre reinforced plastic.

The wings and horizontal and vertical tail surfaces are fixed surfaces. Control of the drone is accomplished by small canard vanes located just forward of the wing and linked directly to the pre-set flight control system. This system and the control surfaces are built up as a single, compact removable unit.

The RP-70 is designed for air-launching and is fitted with radar augmentation devices to give it the appearance of a conventional piloted fighter aircraft on a radar screen. Its payload capabilities are sufficient to enable it to carry special tracking and scoring equipment.

DIMENSIONS.—
Span 5 ft. (1.52 m.).
Length 9 ft. (2.74 m.).



The Radioplane RP-70 Rocket-propelled Target Drone.

THE RADIOPLANE OQ-19.

U.S. Air Force and Army designation: OQ-19B and OQ-19D.
U.S. Navy designation: KD2R.

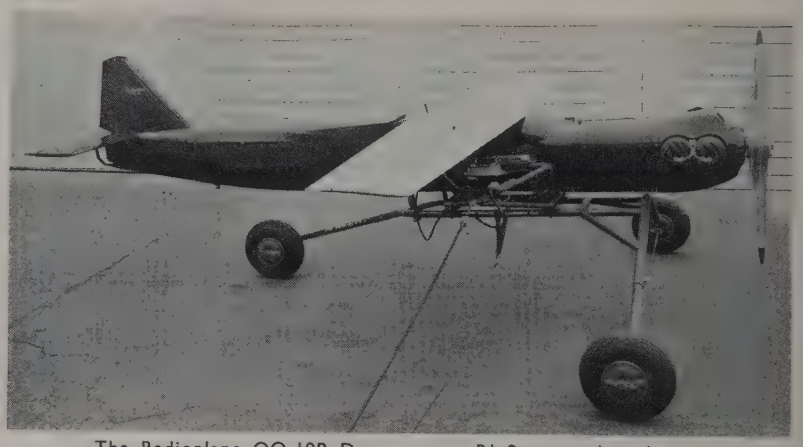
This aerial target is currently in use by the U.S. Air Force, Army Field Forces and the U.S. Navy as a training device for anti-aircraft gunnery. It is powered by a McCulloch O-100-1 four-cylinder two-stroke air-cooled engine rated at 72 h.p. at 4,150 r.p.m.

The OQ-19 is launched from a Radioplane A-7 catapult, is remotely controlled by radio and, after the completion of its mission, is recovered by the use of a radio-released 36 ft. (10.9 m.) parachute. In the event of serious damage by gunfire or loss of radio control, the parachute is deployed automatically. The target is of aluminium-alloy construction and is easily repaired if damaged by gunfire.

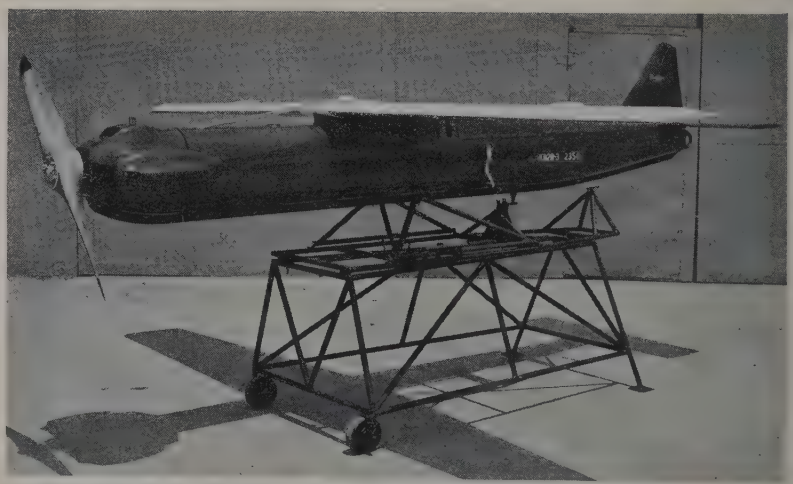
DIMENSIONS.—
Span 11 ft. 6 in. (3.50 m.).
Length 12 ft. 3 in. (3.74 m.).

WEIGHT.—
Ready for flight 317 lb. (144 kg.).

PERFORMANCE.—
Max. speed 227 m.p.h. (363 km.h.).
Rate of climb 2,400 ft./min. (730 m./min.).
Service ceiling 23,000 ft. (7,010 m.).
Endurance 1 hour.



The Radioplane OQ-19B Drone on an RL-2 rotary launcher.



The Radioplane KD2R-3, the naval version of the OQ-19 Drone. The KD2R-5 production model is similar but has out-of-sight control.

THE RADIOPLANE RP-71.

With fuselage modifications and equipped with a Signal Corps K-25 still camera or a ciné camera, the OQ-19

drone is designated RP-71. It serves as a U.S. Signal Corps short-range battle-field surveillance device. The cameras can be operated during flight by the drone's radio-control system.

THE RADIOPLANE RP-77.

The RP-77 is a high-altitude all-plastic drone which has completed successfully its initial flight tests. It offers a choice of three engine installations to satisfy mission and economy requirements. These are a McCulloch turbo-supercharged engine (RP-77B); a Lycoming SO-360-M with a gear-driven supercharger (RP-77C); and a Boeing 502-10 free-turbine turboprop engine (RP-77D).

The airframe of the RP-77 is of Fiberglass laminate construction and a new and improved RPS-8 type remote flight control system is installed.

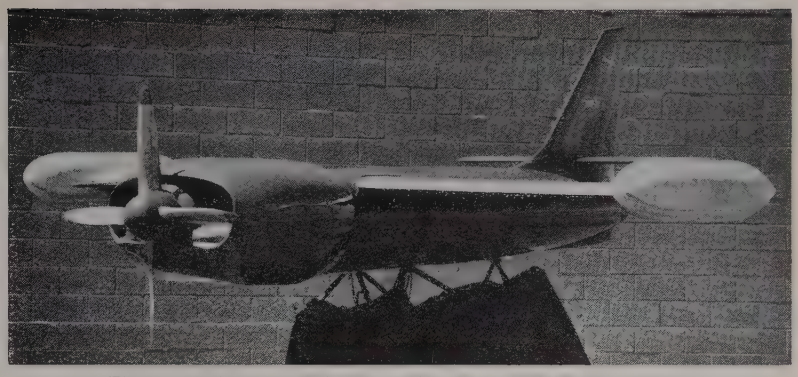
DIMENSIONS.—
Span (all models) 11 ft. 9 in. (3.58 m.).
Length (RP-77B) 13 ft. (3.96 m.).
Length (RP-77C and D) 13 ft. 6 in. (4.12 m.).

WEIGHTS.—
Gross weight (RP-77B) 610 lb. (276.9 kg.).
Gross weight (RP-77C) 846 lb. (384 kg.).
Gross weight (RP-77D) 808 lb. (366.8 kg.).

PERFORMANCE (RP-77B).—
Max. level flight speed 322 m.p.h. (515 km.h.).
Rate of climb at S/L. 2,750 ft./min. (840 m./min.).
Service ceiling 35,000 ft. (10,675 m.).
Endurance 1 hour.

PERFORMANCE (RP-77C).—
Max. level flight speed 374 m.p.h. (598 km.h.).
Rate of climb 3,800 ft./min. (1,160 m./min.).
Service ceiling 39,000 ft. (11,900 m.).
Endurance 1 hour.

PERFORMANCE (RP-77D).—
Max. level flight speed 420 m.p.h. (672 km.h.).
Rate of climb 7,300 ft./min. (2,836 m./min.).
Service ceiling 48,000 ft. (14,640 m.).
Endurance 1 hour.



The Radioplane RP-77C Drone (Lycoming SO-360-M engine).



The Radioplane RP-77D Drone (Boeing 502-10 turboprop engine).

RAWDON

RAWDON BROTHERS AIRCRAFT, INC.

HEAD OFFICE AND WORKS: P.O. Box 1119, WICHITA 1, KANSAS.

Manager: Gene Rawdon.

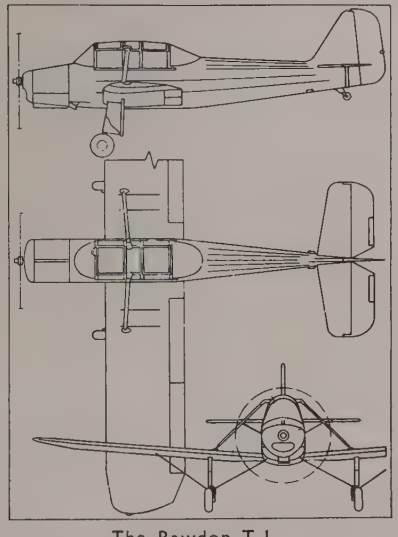
Rawdon Bros. Aircraft, Inc. has designed and built the T-1 two-seat monoplane, and is developing an advanced version of this aircraft with a 180 h.p. Lycoming engine, of which no details are yet available. It also manufactures aircraft spraying and dusting equipment, accessories, etc. and operates overhaul and maintenance shops.

THE RAWDON T-1.

The Rawdon T-1 is intended primarily as a two-seat trainer; but is suitable for touring, crop-spraying and other duties. With an 80 U.S. gallon (302 litre) streamlined external spray tank installed under its fuselage, cruising speed is reduced by only about 4 m.p.h. (6.4 km.h.).

TYPE.—Two-seat Training monoplane.

WINGS.—Low-wing semi-cantilever monoplane. Modified Göttingen 398 wing section. Chord 5 ft. 2 in. (1.57 m.). Dihedral 4° 30′. All-metal structure. Single steel-tube struts in plane of the main spar brace landing-gear attachment points to steel-tube pylon, between two seats. Steel-tube-framed ailerons and flaps are fabric covered. Gross wing area 166 sq. ft. (15.5 m.²).



The Rawdon T-1.

FUSELAGE.—Welded steel-tube structure covered with fabric over wooden formers.

TAIL UNIT.—Braced monoplane type. Welded steel-tube frames covered with fabric. Statically-balanced rudder and elevators. Plywood-covered trim-tabs in both elevators. Span of tail 10 ft. 2 in. (3.09 m.).

LANDING GEAR.—Fixed tail-wheel type. Consists of two vertical welded steel-tube frames braced to wing spar on both sides by sloping struts. Rawdon oleo-spring shock-absorbers hinged at their lower extremities by torque links. Goodyear wheels and hydraulic disc brakes. Full swivelling and steerable tail-wheel on Maule oleo-spring strut. Track 9 ft. 11 in. (3 m.).

POWER PLANT.—One 150 h.p. Lycoming O-320 four-cylinder horizontally-opposed air-cooled engine. Sensenich fixed-pitch metal airscrew. Hartzell constant-speed airscrew optional. Two Goodyear Pliocel flexible fuel tanks in wing roots. Normal fuel capacity 38 U.S. gallons (144 litres), optional 44 U.S. gallons (166 litres).

ACCOMMODATION.—Tandem seats with dual controls under transparent canopy. Upper panels over seats hinge to right side for access and exit. Vertically sliding lower side panels. Baggage compartment aft of rear seat. Optional equipment includes an 80 U.S. gallon (302 litre) external spray tank for agricultural duties.

DIMENSIONS.—
Span 33 ft. 4 in. (10.16 m.).
Length 24 ft. 2 in. (7.52 m.).
Height 7 ft. 3 in. (2.21 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,300 lb. (590 kg.).
Weight loaded 1,900 lb. (863 kg.).
Wing loading 11.4 lb./sq. ft. (55.6 kg./m.²).
Power loading 12.7 lb./h.p. (5.76 kg./h.p.).

PERFORMANCE (150 h.p. Lycoming O-320 engine and fixed-pitch airscrew).—
Max. speed 138 m.p.h. (221 km.h.).
Cruising speed (65% power) 120 m.p.h. (192 km.h.).
Landing speed (with flaps) 50 m.p.h. (80 km.h.).
Initial rate of climb 900 ft./min. (275 m./min.).



The Rawdon T-1 (150 h.p. Lycoming O-320 engine).

Service ceiling 18,000 ft. (5,490 m.).
Cruising range 500 miles (800 km.).
Take-off to clear 50 ft. (15.25 m.) with 12° flap 600 ft. (183 m.).
Landing distance from 50 ft. (15.25 m.) with 30° flap 600 ft. (183 m.).

THE RAWDON T-1S.

This is a crop-spraying version of the T-1, with which it is identical except for the installation of a spray tank and equipment. The spray manifolds are entirely within the wings, only the nozzles projecting below the lower surface. The tank holds up to 800 lb. of spray material. All spray equipment, except the manifolds, is quickly removable.

THE RAWDON T-1SD.

A further development of the basic T-1 design, the new T-1SD agricultural aircraft has a large Fiberglass hopper in place of the normal rear cockpit enclosure and end plates on the wing-tips. The usual landing gear side bracing struts have been eliminated, but otherwise it is generally similar to the T-1, with the same 150 h.p. Lycoming O-320 engine. It can be used either for dusting with powder or spraying with liquids.



The Rawdon T-1SD (150 h.p. Lycoming O-320 engine).

REPUBLIC

THE REPUBLIC AVIATION CORPORATION.

Head Office and Works: Farmingdale, Long Island, N.Y.

Guided Missiles Division: 233, Jericho Turnpike, Mineola, Long Island, N.Y.

President: Mundy I. Peale.

Vice-President in charge of Research and Development: Alexander Kartveli.

Vice-President and General Manager: Walter G. Bain.

Vice-President and Assistant to the President: Ken Ellington.

Vice-President in charge of Industrial Relations: John J. Ryan.

Vice-President in charge of Sales: L. L. Brabham.

Vice-President: Martin F. Scanlon.

Vice-President in charge of European Operations: Alden R. Crawford.

Secretary: John A. Thompson.

Treasurer: Tom Davis.

Production facilities of the Republic Aviation Corporation are devoted entirely to the production of military aircraft and missiles.

Production of the F-84 Thunderjet came to an end on July 27, 1953, with the delivery of the 4,457th and last to the U.S.A.F. In addition to its widespread service with the U.S.A.F., the Thunderjet has been supplied under the Mutual Defence Assistance Plan to France, Belgium, the Netherlands, Norway, Italy, Greece, Denmark, Portugal, Turkey, Yugoslavia and Formosa.

A full description of the Thunderjet has appeared in earlier editions of "All the World's Aircraft."

The F-84F Thunderstreak fighter-bomber, with the RF-84F Thunderflash, is in large-scale service with the U.S.A.F. and the air forces of nine N.A.T.O. powers. To supervise the assembly, maintenance, modification and repair of these aircraft in Europe, a company known as Republic Aviation International was formed in Lugano, Switzerland, in 1953 and this company now has contracts with 15 major European aircraft and equipment manufacturers in the United Kingdom, France, Germany, the Netherlands and Italy.

The new F-105 Thunderchief supersonic fighter-bomber was ordered into production in 1956, following very successful initial flight tests. An RF-105 photo-reconnaissance version is also under development.

Development of two other advanced aircraft is continuing under U.S.A.F. contracts. These are the XF-103 supersonic interceptor and an unspecified fighter-bomber which the U.S.A.F. will consider for procurement in 1960-65.

Republic has many other engineering projects in hand. In particular, its Guided Missiles Division is producing nose-cone structural units for an intercontinental ballistic missile under subcontract to General Electric Company; and is working on two missile systems, one of which concerns an air-to-air missile and its guidance equipment and the other an air-to-surface fire control system for directing an airborne missile towards a target on sea or land.

In August, 1957, it was announced that the Guided Missiles Division had been awarded U.S. Army contracts for two new types of aerial drone aircraft suitable for all-weather battlefield reconnaissance. One will be an airscrew-driven type for immediate operational use; the other will be of more advanced design. Both drones will be zero-length launched and will be recoverable. The contracts cover design, development and production.

In addition, this Division has produced the two-stage Terrapin lightweight high-altitude research missile, which is described in the "Guided Missiles" section of this work, and is developing a third-stage rocket for the Terrapin which will enable it to climb to heights of 200 miles (320 km.) or more.

In the Spring of 1957 it was announced that Republic had formed a Scientific Research Staff of specialists in nuclear physics, applied mathematics, electronics and aerophysics for basic research in the fields of ultra high-speed aircraft and guided missiles.

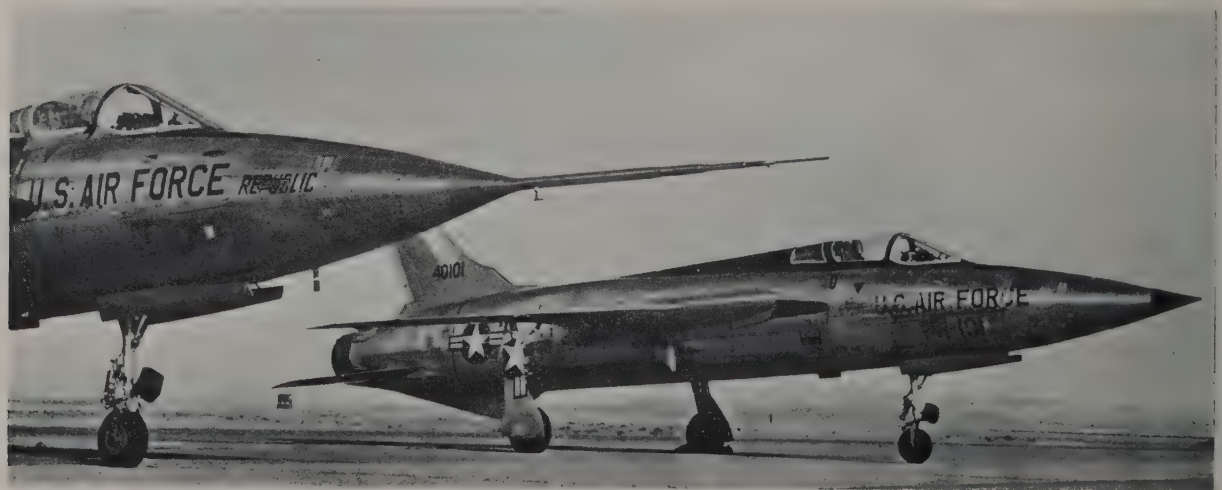
THE REPUBLIC F-105 THUNDERCHIEF.

The F-105 has been developed to meet U.S.A.F. requirements for a supersonic single-seat fighter-bomber able to deliver nuclear weapons as well as heavier loads of conventional bombs and rockets at very high speeds and over long ranges. It is classed as a "weapons system," because all integral components were designed as a unified whole to accomplish this specific mission.

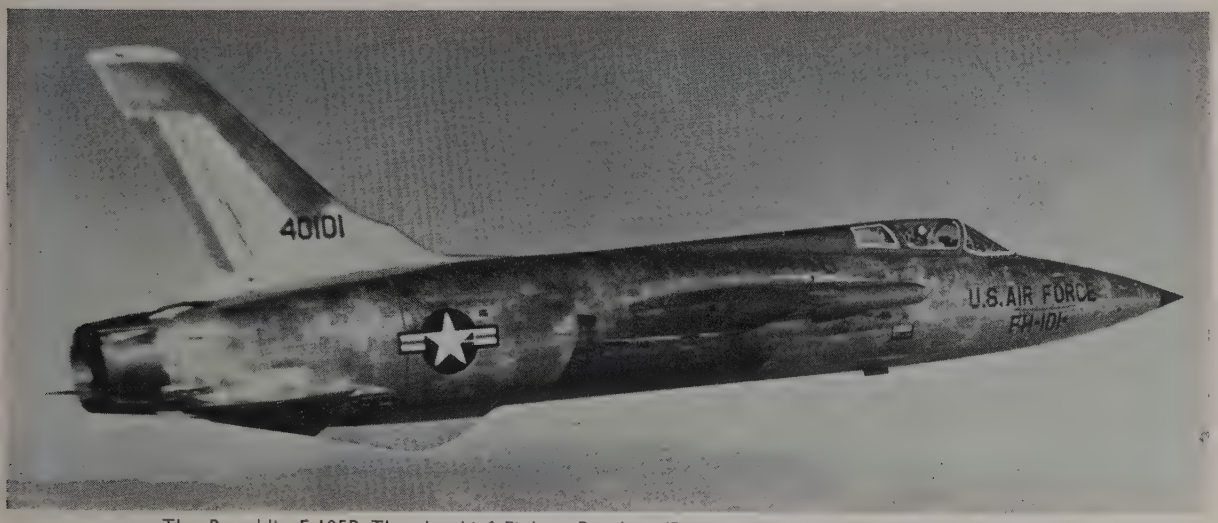
The following versions have been announced:—

YF-105A. The prototype of this version exceeded Mach 1 during its initial test flight on October 22, 1955, powered by a Pratt & Whitney J57 turbojet engine. Six built.

F-105B. With "area-ruled" fuselage, and powered by a Pratt & Whitney J75 turbojet engine, the first of this developed version was delivered to the U.S.A.F.'s Flight Test Center in the Spring of 1956. In production.



The Republic F-105B Thunderchief Fighter-Bomber (Pratt & Whitney J75 turbojet engine).



The Republic F-105B Thunderchief Fighter-Bomber (Pratt & Whitney J75 turbojet engine).

RF-105. Photographic-reconnaissance version.

TYPE.— Single-seat Supersonic Fighter-bomber.

WINGS.—Cantilever mid-wing monoplane. Very thin wing section. Highly-swept, with controllable conical cambered leading-edge and unique swept-forward air intake ducts in wing root leading-edges to provide double shock-wave to slow compressor air and to reduce turbulance in way of tail-plane. All-metal structure.

FUSELAGE. — All-metal semi-monocoque structure with "wasp-waist" in way of wings in accordance with Area Rule. Radar in nose. Large internal weapons bay under wing position. "Clover-leaf" speed brakes form last 3 ft. (0.91 m.) of fuselage around tail-pipe.

TAIL UNIT.—Cantilever monoplane type. All surfaces highly swept. Ram air intake in base of fin to provide cooling air for rear end of aircraft. One-piece "flying tail" set low on fuselage. Under-fuselage ventral stabilising fin. All-metal structure.

LANDING GEAR.—Retractable tricycle type. Main units retract inward into wings. Nose-wheel retracts forward into fuselage.

POWER PLANT.—One Pratt & Whitney J75 turbojet engine with afterburner. Provision for flight refuelling at supersonic speeds and high altitudes.

ACCOMMODATION.—Pilot seated in pressurised cabin. High degree of automation in navigation and bombing systems. General Electric automatic flight-control system.

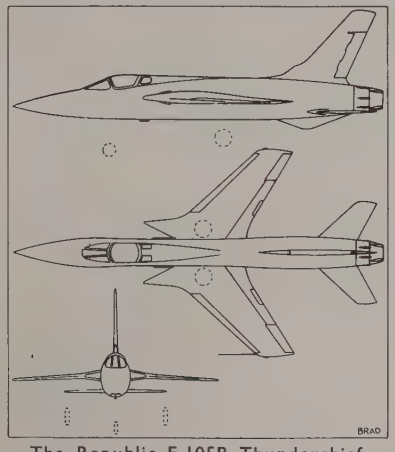
ARMAMENT.—Conventional or nuclear weapons in internal weapons bay in fuselage and externally under wings.

DIMENSIONS.—
Span 34 ft. 11 in. (10.64 m.).
Length 63 ft. 1 in. (19.23 m.).
Height 19 ft. 8 in. (6.00 m.).

WEIGHTS AND PERFORMANCE.—
No details available.

THE REPUBLIC THUNDERSTREAK.
U.S.A.F. designation: F-84F.

This aircraft was originally intended to be a swept-wing version of the F-84E



The Republic F-105B Thunderchief.

Thunderjet, with an Allison J35-A-29 engine (5,800 lb.=2,630 kg. s.t.), and a prototype was flown with a lower-powered version of this engine. This prototype was redesignated YF-96A, which was to be the designation of production aircraft; but it later reverted to the designation of XF-84F.

The impending availability of the higher-powered Sapphire engine, for which Curtiss-Wright had acquired a manufacturing licence, resulted in the decision to re-design the airframe to take this engine.

The new power-plant, with its larger dimensions and greater power, called for a considerable number of design and production changes with the result that, compared with the F-84E, the swept-wing F-84F is almost entirely a new aeroplane. The first XF-84F powered by an imported British-built Sapphire engine flew for the first time on February 14, 1951.

The following is the sole production version of the Thunderstreak.

F-84F. Standard production version with Wright J65 engine (7,200 lb.=3,270 kg. s.t.). Production F-84F's went into service with the U.S.A.F. in 1954. The F-84F has also been supplied in quantity to the air forces of several NATO nations. 2,711 were built before production ended in July, 1957.

The description below refers to this version :—

TYPE.—Single-seat Jet Fighter.

WINGS.—Mid-wing cantilever monoplane. Sweepback 40° at quarter-chord. All-metal structure incorporating a high proportion of press forgings in place of built-up components.

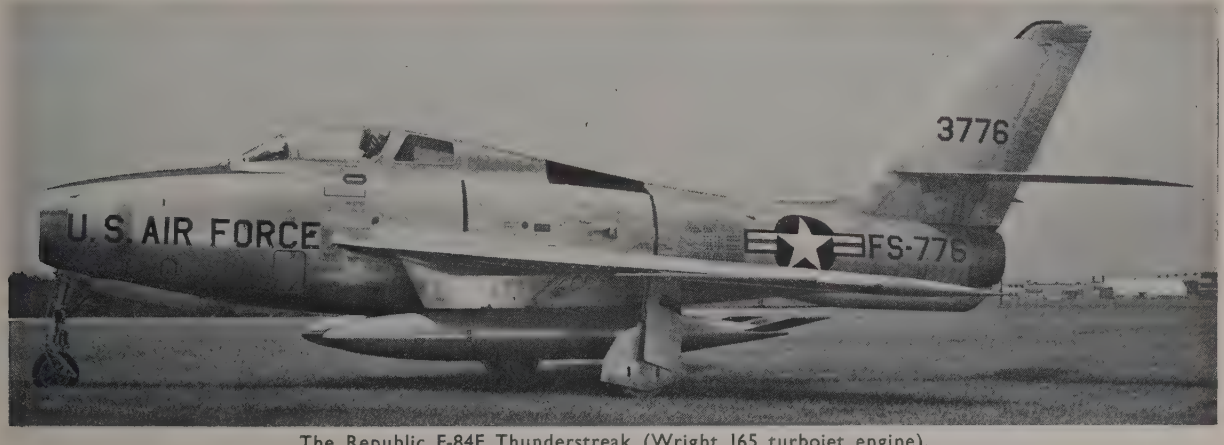
FUSELAGE.—All-metal structure with flush-riveted stressed skin. Perforated air-brakes hinged to the fuselage sides aft of the wing trailing-edge. A drag parachute is provided to shorten landing distances.

TAIL UNIT.—Cantilever monoplane type, with one-piece "flying" tailplane high-mounted on fin. Sweepback 40° at quarter-chord. All-metal structure.

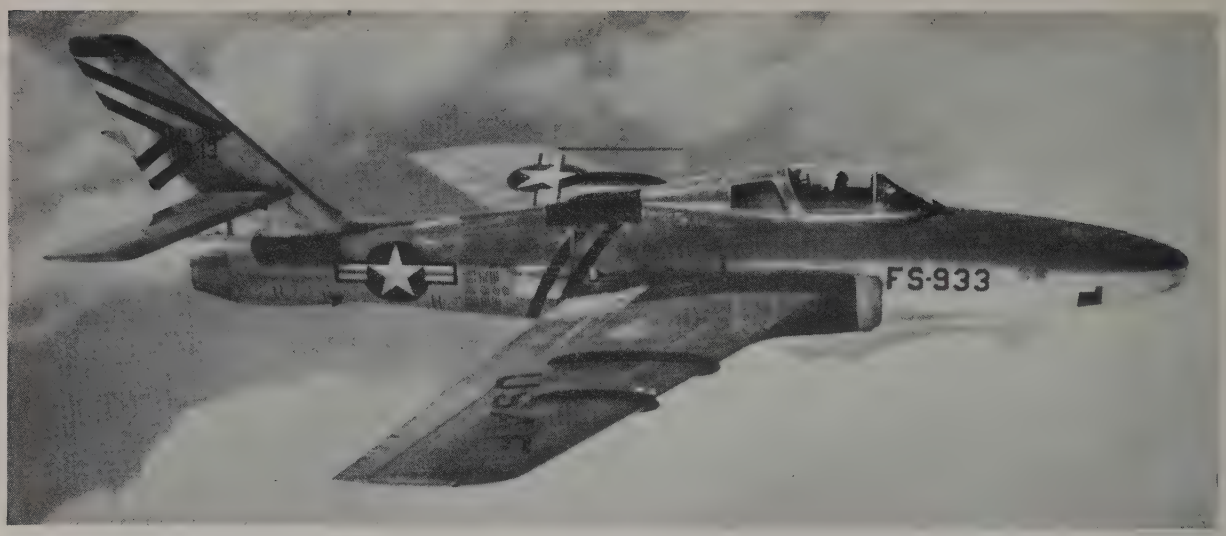
LANDING GEAR.—Retractable tricycle type. Hydraulic retraction.

POWER PLANT.—One Wright J65-W-3 turbojet engine (7,200 lb.=3,270 kg. s.t.). External fuel tanks may be carried on wing-root pylons. Normally, two 230 U.S. gallon (870 litre) drop tanks would be carried, but two 450 U.S. gallon (1,700 litre) tanks are permissible for long-range escort missions. Provision for in-flight refuelling, including a new Republic-developed "buddy" system.

ACCOMMODATION.—Pilot's pressurised cockpit ahead of wing leading edge. Upward-hinged jettisonable canopy. Pilot's ejector seat.



The Republic F-84F Thunderstreak (Wright J65 turbojet engine).



The Republic RF-84F Thunderflash, the Tactical Reconnaissance version of the F-84F.

ARMAMENT.—Six .50 in. (12.7 mm.) machine-guns, four in the fuselage and one in each wing. Provision for carrying external stores including twenty-four 5 in. rockets, or four 1,000 lb. bombs, or atomic weapons, up to a maximum weight of more than 6,000 lb. (2,720 kg.).

DIMENSIONS.—
Span 33 ft. 6 in. (10.21 m.).
Length 43 ft. 4 in. (13.21 m.).
Height 14 ft. 4 in. (4.37 m.).

WEIGHTS.—
Weight loaded (approx.) 25,000 lb. (11,350 kg.).

PERFORMANCE.—
Max. speed over 650 m.p.h. (1,040 km.h.).
Combat radius over 1,000 miles (1,600 km.).
Service ceiling over 45,000 ft. (13,725 m.).

THE REPUBLIC THUNDERFLASH. U.S.A.F. designation: RF-84F.

The Thunderflash is the tactical reconnaissance version of the F-84F. Unlike the Thunderstreak which has a nose air-intake, this version has wing-root intakes so as to enable it to carry cameras, radar and electronic equipment in the fuselage nose. An armament of four .50-in. machine-guns, two in each wing, is provided for self protection.

The RF-84F, which went out of production in December, 1956, is in service in several commands of the U.S.A.F., the U.S. Air National Guard and in the air forces of Belgium, France, Italy, Greece, Norway, Turkey and the Netherlands. 715 were built.

The RF-84F is equipped to carry any combination of the 15 standard U.S. aerial cameras, plus the "dicing" camera for close-up photographs of individual targets and several special night cameras. In addition, it can be equipped with the Tri-Metrogon camera which takes horizon-to-horizon photographs. For night operations a large number of magnesium flares in flash ejector cartridges can be carried under the wings.

The Thunderflash has a camera control system with an automatic computer which analyzes factors of light, speed and altitude and automatically sets the cameras. This virtually eliminates camera error. A special viewfinder enables the pilot to see exactly what he is photographing.

Equipment also includes a wire recorder for the pilot to make "notes" during photographic or visual reconnaissance missions.

The standard version of the RF-84F is powered with a Wright J65-W-3 turbojet engine (7,200 lb. = 3,270 kg. s.t.).

DIMENSIONS.—
Span 33 ft. 6 in. (10.21 m.).
Length 47 ft. 6 in. (14.48 m.).
Height 15 ft. (4.57 m.).

WEIGHTS.—
Restricted.

PERFORMANCE.—
Max. speed over 650 m.p.h. (1,040 km.h.).
Combat radius over 1,000 miles (1,600 km.).
Service ceiling over 45,000 ft. (13,725 m.).

RIDDLE

RIDDLE AIRLINES, INC.

HEAD OFFICE AND WORKS: MIAMI INTERNATIONAL AIRPORT, FLORIDA.

President: J. P. Riddle.

Riddle Airlines, who operate one of the world's largest commercial fleets of Curtiss C-46 transport aircraft, have produced a modification scheme which adds 40 m.p.h. to the cruising speed of the C-46 and enables it to carry an extra ton of payload. In addition, the modified aircraft meets the T-category requirements of the Civil Aeronautics Administration, which must be conformed to by all C-46 operators in the United States, and can be used for scheduled passenger services.

In addition to modifying their entire fleet of 32 C-46's, Riddle Airlines are offering to modify aircraft owned by other companies and have licensed Aeronavali of Venice, Italy, to carry out similar conversions for C-46 operators in Europe. Initially, Aeronavali have a contract to modify four aircraft for Westair Transport of Seattle.

THE RIDDLE C-46R.

The C-46R is powered by two 2,100 h.p. Pratt & Whitney R-2800 eighteen-cylinder two-row radial engines, which enable it to carry a ton more payload than the standard C-46 and to climb with a full load with one engine inoperative. It provides maximum accommodation for 50 passengers or equivalent freight.

To reduce operating and maintenance costs, off-the shelf production items are used wherever possible. The new engines allow longer maintenance-free operation due to improved design. Ignition analyzer systems are installed. Fuel flow indicators and manual-leaning carburettors are used to reduce fuel consumption. An electrically-powered auxiliary hydraulic pump allows adjustments without use of external hydraulic sources.

New safety features include an Edison "continuous wire" fire detection system; a Kidde CF3BR extinguisher system; a stainless steel secondary firewall to isolate the power section, and fireproofed



The Riddle C-46R Transport (two 2,100 h.p. Pratt & Whitney R-2800 engines).

fuel and oil lines and all emergency wiring in fire zones. The baggage compartments are sealed for fire protection.

The instrument panel has been completely redesigned using suggestions from Riddle Airlines' pilots, and includes red night-lighting. New Janitrol cabin and cockpit heaters are installed, together with improved radio and radio-navigational equipment and new wheel and brake assemblies developed by B. F. Goodrich and Company.

DIMENSIONS.—
Span 108 ft. 1 in. (32.9 m.).
Length 76 ft. 4 in. (23.3 m.).
Height 21 ft. 9 in. (6.6 m.).

WEIGHT.—
Weight loaded 49,900 lb. (22,634 kg.).
Max. landing weight 48,000 lb. (21,770 kg.).

PERFORMANCE.—
Cruising speed (55% power) at 9,000 ft (2,745 m.) 235 m.p.h. (378 km.h.).
Rate of climb at S/L. 1,140 ft./min. (350 m./min.).
Rate of climb at S/L. one engine out, 330 ft./min. (100 m./min.).
Service ceiling 22,000 ft. (6,700 m.).
Take-off distance to 50 ft. (15.25 m.) 5,500 ft. (1,675 m.).
Landing distance 3,400 ft. (1,035 m.).
Max. range 1,600 miles (2,575 km.).

ROTOR-CRAFT

ROTOR-CRAFT CORPORATION.

HEAD OFFICE AND WORKS : GLENDALE, CALIFORNIA.

President : Gilbert Magill.

The Rotor-Craft Corporation has designed and built, under U.S. Navy contracts, an ultra-lightweight one-man helicopter, brief details of which follow :—

THE ROTOR-CRAFT RH-1 PINWHEEL.

The Model RH-1 was designed to carry one fully-armed soldier and its structure has therefore been kept as simple as possible. The "backbone" of the vehicle consists of a reinforced curved steel tube which supports the two-blade rocket-driven rotor, the pilot's seat and a simple tubular tail-boom which carries the steering tail rotor. The tail rotor is driven by a belt passing over a pulley on the main rotor shaft. A small fixed inverted Vee horizontal stabiliser is located aft of the tail rotor. The pilot's legs and feet serve as the landing gear. When not supported by the pilot, the helicopter rests on a parking stand. The diminutive rotor-tip rockets, which weigh less than one pound each, use liquid 90% hydrogen-peroxide as a mono-propellent.

An overhead type of cyclic control stick is used. The usual collective-pitch stick with twist-grip throttle handle is located at the pilot's left. Because the feet are used for landing there are no rudder pedals. Steering, by changing the pitch of the tail rotor, is accomplished by twisting the horizontal cyclic handle right or left.



The Rotor-Craft RH-1 Pinwheel Lightweight Helicopter.

The pilot occupies a pivotal seat and is secured in place by shoulder and waist straps. Instruments consist of a rotor tachometer, airspeed indicator and fuel quantity gauge, located on a panel above the handle on the cyclic control stick.

The helicopter equipped weighs less than the average pilot and can lift double its own weight. It can be folded up, dropped by parachute, stowed aboard a submarine and two can be carried inside a station wagon.

The Model RH-1 made its first free flight in 1954.

RYAN

THE RYAN AERONAUTICAL COMPANY.

HEAD OFFICE AND WORKS : LINDBERGH FIELD, SAN DIEGO 12, CALIFORNIA.

President : T. Claude Ryan.

Executive Vice-President : G. C. Woodard.

Vice-President and Chief Engineer : Frank W. Fink.

Vice - President Engineering : Bruce Smith.

Secretary and Treasurer : C. A. Stillwagen.

Sales Manager : Sam C. Breder.

The Ryan Aeronautical Company is a successor to the old Ryan Company which produced the aeroplane in which Mr. Charles Lindbergh made the first non-stop flight from New York to Paris in 1927.

In the Summer of 1947, the Ryan company acquired the design and manufacturing rights of the Navion four-seat all-metal light cabin monoplane from North American Aviation, Inc. Over 1,000 civil Navions were built during the years 1948-50, but production was suspended in 1951 to enable the company to devote its entire activities to the Defense Programme.

The current activities of the Ryan Aeronautical Company are diversified and fall into four main groups :—(*a*) research and development in and the manufacture of aircraft and aeronautical products of the company's own design ; (*b*) production of airframe components for other manufacturers ; (*c*) the production of high-temperature parts for aircraft engines ; and (*d*) electronics systems.

Important aeronautical research programmes, including production of the Ryan Firebee pilotless jet-powered target aircraft, are being conducted for the U.S. Air Force, Army and Navy. Prime contracts are held for the development of guidance systems for missiles and other electronic devices of Ryan design.

Among airframe components of Ryan design being manufactured in volume are aft fuselage sections, each 60 ft. (18.3 m.) long, for Boeing KC-135 jet tanker-transports and Model 707 Jet Stratoliners and complete engine pods and pylons for the Douglas DC-8 jet transport.

For aircraft engines Ryan builds heat and corrosion-resistant stainless-steel components, and applies ceramic coatings for jet engines, piston engines and rocket motors. Products include such items as exhaust cones, tail pipes, combustion chambers, afterburners and exhaust nozzles for jet engines, exhaust systems for aircraft piston engines, and complete rocket motors for guided missiles.

THE RYAN VERTIPLANE.

In June, 1956, Ryan announced that it had received a contract to build a vertical take-off aircraft for the U.S. Army. To be known as the Vertiplane, this aircraft will have a conventional high-wing monoplane configuration, but with very extensive double retractable wing flaps which extend far below and to the rear of the wing trailing edge.

The Vertiplane will be powered by a single gas-turbine engine, mounted in its fuselage and driving two wing-mounted airscrews of large diameter. The deflected slipstream from these, over the extended flaps, is expected to enable the aircraft to take off and land vertically, hover and even fly sideways or backwards.

Duties of the Vertiplane will be medium speed liaison, light passenger and cargo transportation.

THE RYAN VERTIJET.

U.S.A.F. designation: X-13.

The Ryan X-13 Vertijet is a small single-seat "tail-sitting" V.T.O. research aircraft, powered by a single Rolls-Royce Avon turbojet engine. Of all-metal construction, it has a high-set delta wing with small fins at the tips and a large vertical fin and rudder. It has no landing gear, taking off instead from a mobile ground servicing trailer, the bed of which is raised hydraulically to a vertical position so that the aircraft is suspended in a nose-up attitude by a hook under its forward fuselage which engages with a trapeze-structure on the trailer-bed.

Ryan received a U.S.A.F. contract to build the X-13 in 1953, and the first prototype flew on December 10, 1955, fitted with a temporary fixed tricycle landing gear to permit normal horizontal take-off and landing. This landing gear was subsequently removed and replaced by a temporary tubular structure to allow the aircraft to be tested in the "tail-sitting" attitude. The first such flight was made on May 28, 1956, followed by simulated hook-ons to a nylon rope stretched between two upright steel towers.

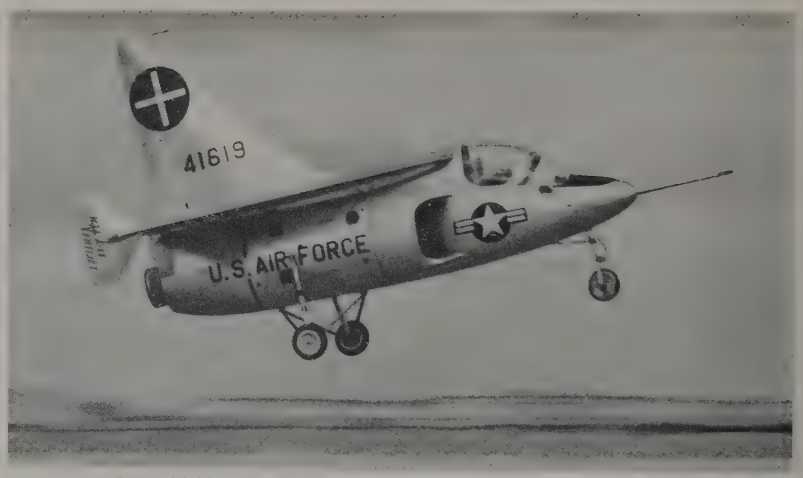
A second prototype, also fitted with temporary tricycle landing gear, made the first transition from horizontal flight to hovering vertical flight and back to horizontal flight on November 28, 1956.

In its fully-developed form, the X-13 unhooks itself from the trailer under the direct jet thrust of its turbojet, and can be hovered and manoeuvred close to the ground. During take-off, landing and hovering flight, it is controlled by deflection of its jet exhaust and thrust (throttle) variations. Conventional control surfaces are provided for horizontal flight, both systems being operated by normal stick and rudder pedal cockpit controls.

The first complete flight sequence of vertical take-off, transition to horizontal cruising flight and return to vertical landing was accomplished on April 11, 1957.

DIMENSIONS (approx.).—
Span 21 ft. (6.40 m.).
Length 24 ft. (7.32 m.).
Height 15 ft. (4.57 m.).

WEIGHTS AND PERFORMANCE.—
No details available.



The Ryan X-13 Vertijet with a temporary conventional landing-gear.



The Ryan X-13 Vertijet and its ground service trailer.

THE RYAN FIREBEE.
U.S. Air Force designation: Q-2.
U.S. Army designation: XM21.
U.S. Navy designation: KDA-1.

The Firebee is a pilotless remotely-controlled high-speed turbojet-powered target drone which has been developed under a joint Air Force/Army/Navy project, with the U.S.A.F. Air Research and Development Command having technical cognizance of its development.

Glide flight tests of the Firebee without power were begun in March, 1951, and the first powered flights were made that Summer at the U.S.A.F. Holloman Air Development Center, Alamogordo, New Mexico. In the subsequent test programme the Firebee was launched from under the wings and from the bomb-bay of a Douglas B-26 carrier.

The following versions have been produced :—

XM21. First production version, ordered by the U.S. Army early in 1953 and now in operation at the Army Ordnance Proving Ground at White Sands, N.M., and at Fort Bliss, Texas, where they are used in training Army troops in the operation of the "Skysweeper" gun and for use as a target for the Nike ground-to-air guided missile. They are ground-launched from a zero-length launcher with the aid of a booster rocket, which is jettisoned after the target's jet engine has taken over.

KDA-1. For U.S. Navy. Original order announced in Spring of 1944. This version can be ramp or air-launched and has flotation gear for recovery at sea. It is being used in connection with the evaluation of guided missiles at the Naval Air Missile Test Center, Point Mugu, Cal., and the Naval Ordnance Test Station, Inyokern, China Lake, Cal. Thirty being built for R.C.A.F.

Q-2A. Standard Firebee for U.S.A.F., to support missile development at Holloman Air Development Center, Alamogordo, N.M., and White Sands; for air-to-air rocket firing practice at Yuma Air Force Base, Arizona; and at the Air Proving Ground Command's Eglin Air Force Base, Florida.

XQ-2B. Developed version for U.S. A.F. with air-to-air radio control, smoke-laying equipment, greater wing area, improved control system and other changes. An XQ-2B, with Continental J69-T-19A turbojet engine, achieved a height of 53,500 ft. (16,300 m.) during a test flight from Holloman A.D.C. After



Two Ryan Firebees, with radar reflector pods at their wing-tips, under the wings of a B-26 carrier.

97 minutes of powered flight it was saved by the standard parachute recovery technique. In this, a two-stage parachute system decelerates the target from its near-sonic operating speed and lowers it safely to the ground without damage to the structure or its delicate electronic controls.

The recovery system is also capable of lowering the drone to the ground automatically in the event of a target hit, loss of radio wave carrier from the remote-control station, engine failure, or upon command by the remote control operator. To prevent damage by dragging, the recovery system incorporates a disconnect system which releases the parachute from the drone upon contact with the ground.

The Firebee is composod of five major assemblies—fuselage, engine nacelle, wing, tail-unit and parachute container. Construction is of aluminium, magnesium and stainless-steel. The wing and tail-unit are attached to the fuselage by four self-aligning bolts. The engine nacelle is hinged to give ready access to the interior of the compartment.

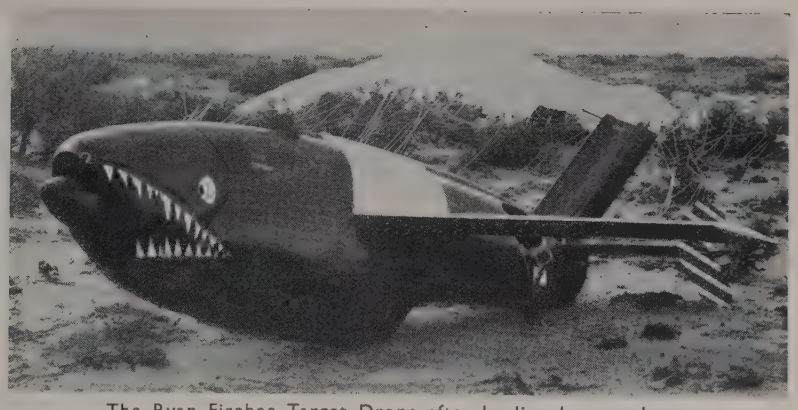
Remote control methods for the Firebee include a choice of radar, radio, active seeker and automatic navigator, all developed and designed by Ryan. Reflectors which are sensitive to radar have been incorporated to give gun crews an image on their radar scopes similar to that of a full-sized aircraft.

The following specification is based on the U.S.A.F. Q-2A version but applies in general to all models except the new XQ-2B.

TYPE.—Remote-controlled Jet Target Drone.

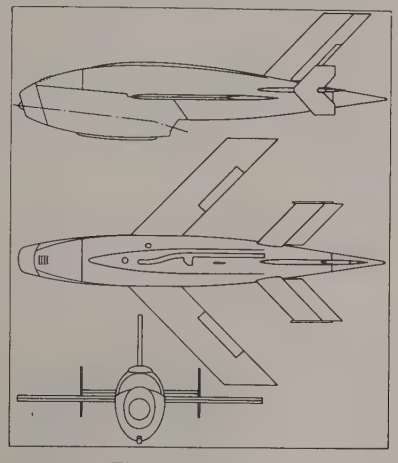
WINGS.—Mid-wing swept type. Aerofoil section NACA 63, A014.6. Aspect ratio 4.62. All-metal one-piece structure attached to fuselage by four bolts. Area of ailerons 2.08 sq. ft. (0.193 m.²) aft of hinge-line. Gross wing area 27.0 sq. ft. (2.508 m.²).

FUSELAGE.—All-metal structure in one complete assembly.



The Ryan Firebee Target Drone after landing by parachute.

TAIL UNIT.—Single assembly attached to fuselage by four bolts. All surfaces swept.



The Ryan Firebee.

Areas: fin 6.07 sq. ft. (0.564 m.²), vertical end plates 5.21 sq. ft. (0.484 m.²), tailplane 8.94 sq. ft. (0.830 m.²) elevators (aft of hinge-line) 3.36 sq. ft. (0.312 m.²).

POWER PLANT.—One Fairchild J44-R-20 or Continental (Turbomeca licence) J69-T-19 turbojet engine (1,000 lb. = 454 kg. s.t. each). Fuel capacity 100 U.S. gallons (378 litres). Oil capacity 1 U.S. gallon (3.78 litres).

DIMENSIONS.—
Span 11 ft. 2 in. (3.40 m.).
Length 17 ft. 3 in. (5.26 m.).
Height 5 ft. 10 in. (1.79 m.).

WEIGHTS.—
Weight empty 1,181.4 lb. (536 kg.).
Weight loaded 1,848.6 lb. (839 kg.).

PERFORMANCE.—
Max. speed at S/L, 610 m.p.h. (976 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 605 m.p.h. (968 km.h.).
Rate of climb at S/L. 8,500 ft./min. (2,590 m./min.).
Time to climb from launch altitude to 40,000 ft. (12,200 m.) 8 min.
Stalling speed 162 m.p.h. (259 km.h.).
Service ceiling 42,500 ft. (12,960 m.).
Endurance at 40,000 ft. (12,200 m.) at 575 m.p.h. (920 km.h.) 1 hr. 20 min.

SCHWEIZER

SCHWEIZER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: COUNTY AIRPORT, ELMIRA, N.Y.

President and Chief Engineer: Ernest Schweizer.

Vice-President and General Manager: Paul A. Schweizer.

Vice-President in charge of Manufacturing: William Schweizer.

Director, Personnel and Public Relations: Eugene S. Bardwell.

Treasurer: Nicholas Haich.

Secretary: Robert P. McDowell.

The Schweizer Aircraft Corpn. specialises in the design and construction of gliders and sailplanes. It also manufactures parts and assemblies for other aircraft companies under sub-contract. The company furthermore maintains a complete aircraft and glider overhaul and repair service.

Schweizer is currently engaged in producing three gliders, the SGU 2-22 two-seat training glider, the SGS 1-23D single-seat high-performance sailplane and the SGS 1-26 single-seat high-performance sailplane which is available both complete and in kit form for the home-builder.

Several changes in the cockpit section of the SGU 2-22 resulted in production of the new SGU 2-22A version during 1957, but no details were available at the time of closing for press.

THE SCHWEIZER SGU 2-22 SAILPLANE.

This two-seat sailplane, which first flew in 1947, has been put back into production to meet training requirements.

TYPE.—Two-seat Utility Training Sailplane.

WINGS.—Strut-braced high-wing monoplane. Aspect ratio 8.81. Aluminium-alloy structure, with metal leading-edge and fabric covering aft. Wing area 210 sq. ft. (19.51 m.²).

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Fin and rudder of aluminium construction with fabric covering. Strut-braced tailplane and elevators of steel-tube construction with fabric covering.

LANDING GEAR.—Single wheel with Goodyear brake mounted on fuselage centre-line immediately aft of a single skid mounted on rubber blocks. Goodyear 6.00 × 6 wheel and tyre.

ACCOMMODATION.—Tandem seating for two persons under transparent canopy. Dual controls.

DIMENSIONS.—
Span 43 ft. (13.1 m.).
Length 25 ft. 0½ in. (7.63 m.).
Height 9 ft. (2.7 m.).

WEIGHTS.—
Weight empty 450 lb. (240 kg.).
Weight loaded 830 lb. (376 kg.).

PERFORMANCE.—
Max. level speed 89 m.p.h. (143 km.h.).
Stalling speed (solo) 28 m.p.h. (45 km.h.).
(dual) 31 m.p.h. (50 km.h.).
Gliding ratio 18 : 1.
Sinking speed (solo) 2.8 ft./sec. (.85 m./sec.)
(dual) 3 ft./sec. (.91 m./sec.).

THE SCHWEIZER SGS 1-23D SAILPLANE.

The SGS 1-23D is the latest development of the 1-23 from which it differs mainly by having wings of higher aspect ratio for increased performance.

The earlier SGS 1-23 was first flown at the 1948 National Soaring Contest at Elmira, N.Y. On December 30, 1950, William Ivans in a 1-23 set a new World's Height Record when he soared to an absolute altitude of 42,100 ft. (12,832 m.) above sea level at Bishop, California. He gained 30,100 ft. (9,180 m.) above his release from aeroplane tow.

Production of the 1-23D was started in July, 1953. The description below refers to this model.

TYPE.—Single-seat High-performance Sailplane.



The Schweizer SGU 2-22 Two-seat Utility Sailplane.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 15.58. All-metal structure. Aileron area (total) 19.40 sq. ft. (1.80 m.²). Spoiler area (total) 5.00 sq. ft. (0.464 m.²). Gross wing area 160 sq. ft. (14.87 m.²).

FUSELAGE.—Semi-monocoque structure of aluminium-alloy.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering. Tailplane span 7 ft. (2.13 m.). Horizontal tail surface area 15.13 sq. ft. (1.405 m.²). Vertical tail surface area 10.61 sq. ft. (0.98 m.²).

LANDING GEAR.—Single unsprung wheel with Schweizer brake on fuselage centre-line, with single skid on solid rubber blocks ahead of wheel. Rubber-mounted tail-skid.

ACCOMMODATION. — Pilot's cockpit with moulded Plexiglas canopy. Fully equipped instrument panel. Room behind pilot for radio, barograph and oxygen equipment.

DIMENSIONS.—
Span 50 ft. (15.25 m.).
Length 20 ft. 9 in. (6.33 m.).
Height 6 ft. 10 in. (2.08 m.).

WEIGHTS AND LOADINGS.—
Weight empty 400 lb. (181.4 kg.).
Pilot 190 lb. (86 kg.).
Extra equipment 160 lb. (72.6 kg.).
Max. permissible loaded weight 750 lb. (340 kg.).
Wing loading 4.69 lb./sq. ft. (22.66 kg./m.²).

PERFORMANCE.—
Designed max. speed 132 m.p.h. (211 km.h.).
Cruising speed 85 m.p.h. (136 km.h.).
Min. sinking speed 2.0 ft./sec. (0.6 m./sec.).
Max. glide ratio 30 : 1.
Glide or Dive Placard speed 119 m.p.h. (190 km.h.).



The Schweizer SGS 1-23D Single-seat Sailplane.

Aeroplane towing speed 110 m.p.h. (176 km.h.).
Auto towing speed 68 m.p.h. (109 km.h.).

THE SCHWEIZER SGS 1-26 SAILPLANE.

Externally similar to the earlier SGS 1-23D, the SGS 1-26 first flew in January, 1954, and production was under way in November, 1954. Whereas the earlier SGS 1-23D is entirely of metal construction, the SGS 1-26, which is available in kit form, has fabric-covered outer wing panels, control surfaces, fuselage and tail-unit. Further to assist the amateur constructor, all the complicated alignments, welding and assemblies requiring specialised tooling are undertaken by the manufacturer, including a pre-formed aluminium nose-cap and Plexiglas canopy. The design has been granted an Approved Certificate (No. TC1G10). From 300 to 600-man-hours are required for assembly depending on the experience and skill of the builder.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 10. Dihedral 3½°. All-metal structure of aluminium alloy. Strengthened metal-covered pre-formed leading-edge. Fabric-covered rear sections of outer wing panels. Spoiler area (two) total 2.78 sq. ft. (0.26 m.²). Wing area 160 sq. ft. (14.87 m.²).

FUSELAGE.—Welded chrome-molybdenum steel tube framework covered with fabric.

TAIL UNIT.—Cantilever monoplane type. Aluminium-alloy structure covered with fabric. Tailplane span 7 ft. 6 in. (2.29 m.).

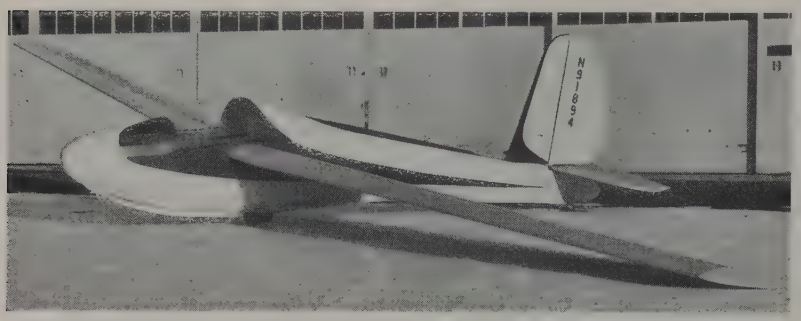
LANDING GEAR.—Single unsprung wheel (4.00-4 with Schweizer brake) on the fuselage centre-line with single skid on solid rubber blocks ahead of wheel. Rubber-mounted tail-skid.

ACCOMMODATION.—Single seat beneath moulded Plexiglas canopy. Provision for radio behind pilot.

DIMENSIONS.—
Span 40 ft. (12.19 m.).
Length 21 ft. 3 in. (6.48 m.).
Height 7 ft. 2½ in. (2.21 m.).

WEIGHTS AND LOADINGS.—
Weight empty 350 lb. (158.76 kg.).
Pilot 190 lb. (86 kg.).
Extra equipment 35 lb. (15.88 kg.).
Max. (gross) weight 575 lb. (260.6 kg.).
Wing loading (normal) 3.13 lb./sq. ft. (15.15 kg./m.²).
Wing loading (max.) 3.54 lb./sq. ft. (17.29 kg./m.²).

PERFORMANCE.—
Min. sinking speed less than 2.5 ft./sec.
Max. glide ratio more than 23 : 1.



The Schweizer SGS 1-26 Sailplane which is marketed in kit form.

SIKORSKY

SIKORSKY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: SOUTH AVENUE, BRIDGEPORT, CONN.

General Manager: B. L. Whelan.

Assistant General Manager: R. A. Aspinwall.

Engineering Manager: Michael E. Gluhareff.

Factory Superintendent: Alex Sperber.

Divisional Controller: Paul W. Holt.
Divisional Auditor: G. L. Wadman.

In addition to the more than 600,000 square feet of production space in operation at its main plant in Bridgeport, Sikorsky Aircraft has opened a branch plant in Stratford. This plant provides another 800,000 square feet of working space which is devoted primarily to production of the S-55 single-engined helicopter and HR2S and H-37 twin-engined helicopters. Production of the S-58 continues in the main plant.

THE SIKORSKY S-55.

U.S.A.F. and U.S. Army designation: H-19.
U.S. Army name: Chickasaw.
U.S. Navy and Coast Guard designation: HO4S.
U.S. Marine Corps designation: HRS.

The S-55 is a twelve-seat utility helicopter suitable for passenger, air mail or cargo transport and for air rescue and military service. The prototype flew on November 9, 1949 and the 1,000th Sikorsky-built helicopter of the basic S-55 type was delivered to the U.S. Marine Corps in mid-1956.



The Sikorsky H-19B Utility Helicopter (700 h.p. Wright R-1300 engine). (*Gordon Williams*).



The Sikorsky HO4S-3 Naval General Utility Helicopter (700 h.p. Wright R-1300 engine). (*Harold Martin*).

Apart from being adopted by the U.S.A.F., U.S. Army Field Forces, U.S. Navy, U.S. Marine Corps and U.S. Coast Guard, the S-55 is also being built under licence in the United Kingdom by Westland Aircraft Ltd. and in France by Sud-Aviation. The British-built S-55, known as the Westland Whirlwind, is in service with the Royal Air Force and the Royal Navy.

There are three commercial models of the S-55, as follows :—

S-55. Standard version with 600 h.p. Pratt & Whitney R-1340 engine, friction clutch and straight tail-boom.

S-55A. With 700 h.p. Wright R-1300-3 engine, hydro-mechanical clutch and inclined tail-boom. In production.

S-55C. As S-55, but with inclined tail-boom. In production.

The many U.S. naval and military versions are enumerated below :—

H-19A. 550 h.p. Pratt & Whitney R-1340-57 engine. For U.S.A.F. A.U.W. 7,200 lb. (3,263 kg.). Crew of two, plus ten troops or six stretchers.

H-19B. 700 h.p. Wright R-1300-3 engine. For U.S.A.F. Rotor diameter 53 ft. (16.16 m.). A.U.W. 7,500 lb. (3,900 kg.). Crew of two, plus ten troops or six stretchers.

H-19C. Same as H-19A for U.S. Army Field Forces.

H-19D. Same as H-19B for U.S. Army Field Forces.

HO4S-1 and -2. 550 h.p. Pratt & Whitney R-1340 engine. Similar to H-19A. For U.S. Navy for anti-submarine duties.

HO4S-2G. For U.S. Coast Guard. HO4S-2 fitted for rescue duties.

HO4S-3. 700 h.p. Wright R-1300 engine. Similar to H-19B. For U.S. Navy for anti-submarine duties.

HRS-1 and -2. 550 h.p. Pratt & Whitney R-1340 engine. Similar to H-19A. For U.S. Marine Corps for assault transport duties. Crew of two and eight fully-armed troops.

HRS-3. 700 h.p. Wright R-1300 engine. Similar to H-19B. U.S. Marine Corps assault transport.

The description and specification which follow refer in general to all current production models.

Type.—Twelve-seat Utility Helicopter.

Rotors.—Three-blade main rotor and two-blade anti-torque tail rotor. All-metal structures.

Fuselage.—Except for the chrome-molybdenum steel-tube rotor pylon, structure is of aluminium and magnesium semi-monocoque construction. On current commercial S-55C's and the versions with R-1300 engine, the tail cone has been sloped down approximately 3½° to increase clearance of main rotor in a rough landing.

Landing Gear.—Quadricycle type. Wheel track 11 ft. (3.35 m.). Alternative gear includes all-metal amphibious landing-gear or permanently-inflated rubber bag flotation gear. For use with the normal wheels, "doughnut" pontoons are available which are stowed deflated on each wheel axle and can be inflated in under 5 sec. when needed for landing on water.

Power Plant.—One Pratt & Whitney R-1340 S3H2 Wasp radial air-cooled engine rated at 550 h.p. at 5,000 ft. (1,525 m.) and with 600 h.p. available for take-off at 3,000 ft. (915 m.), or one Wright R-1300-3 radial air-cooled engine rated at 700 h.p.



The Sikorsky S-55 Commercial Helicopter (700 h.p. Wright R-1300 engine).



The Sikorsky H-37A Military Cargo and Troop Transport (two 1,900 h.p. Pratt & Whitney R-2800 engines).

at 7,300 ft. (2,222 m.) and with 800 h.p. available for take-off at 5,500 ft. (1,675 m.). Engine on angular mounting in nose of fuselage with sloping shaft drive to rotor gear box below head. With the R-1300 engine, a hydro-mechanical clutch with free wheel system is used in the drive to the main transmission, and the drive-shaft from the free wheel unit to the main transmission has flexible rubber couplings on each end. Large clam-shell doors in nose of fuselage allow complete accessibility to engine from ground level. Internal fuel capacity 185 U.S. gallons (700 litres).

ACCOMMODATION.—Pilot's compartment above main cabin seats two side-by-side with dual controls. Cabin located below main lifting rotor may seat from seven (commercial) to ten (military) passengers, the ten passengers being seated three against front and rear walls and two on each side, all facing inwards. Up to six stretchers may be carried, which can be loaded by optional hydraulic power-operated hoist while aircraft is hovering. Pilot's compartment may be entered from the outside or from the cabin so that co-pilot may act as attendant. Cabin dimensions: length 10 ft. (3.05 m.), width 5 ft. 2 in. (1.58 m.), height 6 ft. (1.82 m.). Total capacity 340 cub. ft. (9.6 m.³).

DIMENSIONS.—
Main rotor diameter 53 ft. (16.16 m.).
Tail rotor diameter 8 ft. 9 in. (2.67 m.).
Fuselage length 42 ft. 2 in. (12.85 m.).
Height overall 13 ft. 4 in. (4.07 m.).

WEIGHTS (R-1340 engine).—
Weight empty 4,888 lb. (2,217 kg.).
Max. disposable load 2,312 lb. (1,046 kg.).
Normal weight loaded 7,200 lb. (3,263 kg.).
Overload max. weight (military versions) 7,900 lb. (3,583 kg.) with 2,632 lb. (1,195 kg.) payload.

WEIGHTS (R-1300 engine).—
Weight empty 5,188 lb. (2,356 kg.).
Max. disposable load 2,312 lb. (1,046 kg.).
Weight loaded 7,500 lb. (3,402 kg.).

PERFORMANCE (R-1340 engine at A.U.W. of 7,200 lb. = 3,263 kg.).—
Max. speed at S/L. 101 m.p.h. (162 km.h.).
Cruising speed (67% power) at 1,000 ft. (305 m.) 85 m.p.h. (137 km.h.).
Max. rate of climb at S/L. 700 ft./min. (213 m./min.).
Hovering ceiling with ground effect 6,400 ft. (1,950 m.) at 6,600 lb. (2,995 kg.) A.U.W.
Service ceiling 9,800 ft. (2,990 m.).
Fuel consumption (cruising) 37 U.S. gallons (140 litres) per hour.
Range (with reserve) 405 miles (650 km.).
Range (at 7,900 lb. = 3,583 kg. A.U.W.) 370 miles (595 km.) at 75 m.p.h. (121 km.h.).

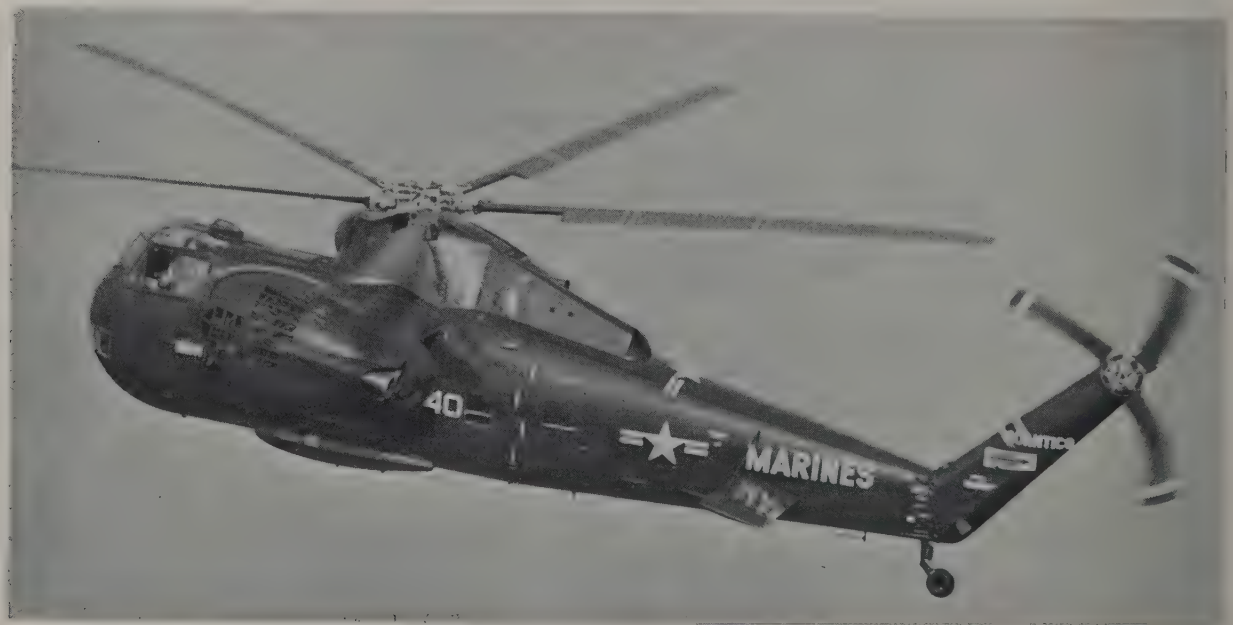
PERFORMANCE (R-1300 engine).—
Max. speed at S/L. 112 m.p.h. (180 km.h.).
Cruising speed (65% power) 91 m.p.h. (148 km.h.).
Max. rate of climb at S/L. 1,020 ft./min. (311 m./min.).
Vertical rate of climb at S/L. 100 ft./min. (35 m./min.).
Hovering ceiling with ground effect 5,800 ft. (1,770 m.).
Hovering ceiling without ground effect 2,300 ft. (700 m.).
Service ceiling 10,600 ft. (3,230 m.).
Fuel consumption (cruising) 43 U.S. gallons (163 litres) per hour.
Range (with reserve) 360 miles (578 km.).

THE SIKORSKY S-56.

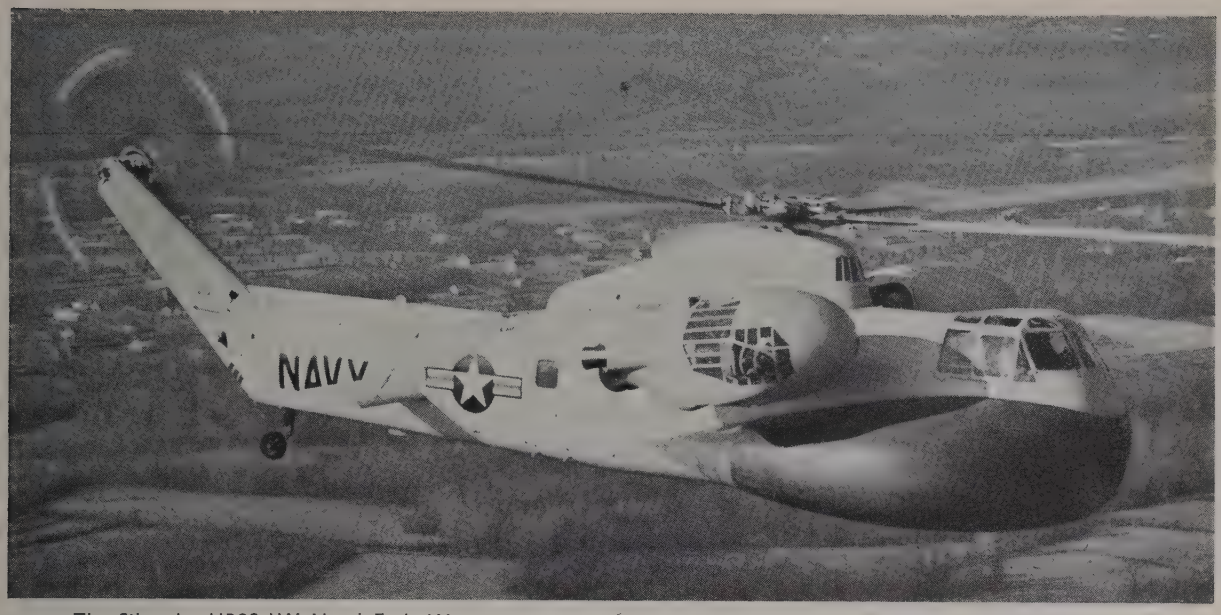
U.S. Navy and Marine Corps designation: HR2S.
U.S. Army designation: H-37A Mojave.

The S-56 is a twin-engined single-rotor transport helicopter which is comparable in size to the Douglas DC-3 transport. It was designed to meet the requirements of the U.S. Marine Corps as an assault helicopter and will carry up to 36 fully-equipped troops or 24 litters or cargo which may comprise three Jeeps, a 105 mm. howitzer or the equivalent in weight and bulk.

The cabin is 30 ft. 4 in. long, 7 ft. 9 in. wide and 6 ft. 8 in. high (9.25 × 2.36 × 2.03 m.) and is fitted with hydraulically-operated clamshell nose doors. A power-operated 2,000 lb. (907 kg.) winch hoist



The Sikorsky HR2S-1 Marine Corps Assault Transport (two 1,900 h.p. Pratt & Whitney R-2800 engines).



The Sikorsky HR2S-1W Naval Early-Warning Helicopter (two 1,900 h.p. Pratt & Whitney R-2800 engines).

with a monorail facilitates loading and handling cargo. It can be used to draw vehicles up the nose ramp or for making air or ground pick-ups at the rear cargo door for subsequent stowage anywhere in the cabin. Bulky loads of up to five tons can be carried under the aircraft in a sling which is equipped with an automatic release to deposit its load upon touch-down when set by the pilot.

The S-56 is powered by two 2,100 h.p. (derated to 1,900 h.p.) Pratt & Whitney R-2800 engines which are mounted in outboard nacelles on short wing stubs. Power from both engines is transmitted to the five-blade main rotor and the four-blade tail rotor, both of which are of all-metal construction and fold for easy handling and stowage aboard aircraft-carriers.

This helicopter is one of the first ever built with a retractable landing-gear, a feature which contributes to its top speed of over 160 m.p.h. (257 km.h.).

The S-56 is fitted with night flying equipment. It has hydraulic servo booster control system, and all-weather flying is made possible by installation of automatic stabilisation equipment. Standard external underwing fuel tanks can be carried for extended range.

Three versions of the S-56 have been built: —

HR2S-1. Basic assault transport for U.S. Marines. Prototype XHR2S-1 made its first flight on December 18, 1953 and the first production HR2S-1 flew on October 25, 1955. In service.

HR2S-1W. Modified version of HR2S-1, with large AN/APS-20E antenna in radome under fuselage nose and additional crew members, for early warning duties.

H-37A. Adaptation of HR2S-1 for medium cargo and troop transport duties with U.S. Army. In service.

In 1956, an HR2S-1 established a new international helicopter speed record of 162.7 m.p.h. (261.8 km.h.) and two altitude with payload records, by lifting 11,050 lb. (5,000 kg.) to more than 12,000 ft. (3,660 m.) and 13,250 lb. (6,000 kg.) to 7,000 ft. (2,135 m.).

DIMENSIONS.—
Main rotor diameter 72 ft. (21.95 m.).
Fuselage length 82 ft. 10 in. (25.25 m.).
Height overall 17 ft. 1 in. (5.21 m.).

WEIGHTS.—
Weight empty 19,704 lb. (8,937 kg.).
Weight loaded 28,500 lb. (12,928 kg.).

PERFORMANCE.—
No details available.

THE SIKORSKY S-58.

U.S. Navy designation: HSS.
U.S. Army designation: H-34 Choctaw.
U.S. Marine Corps designation: HUS-1.

The first prototype of this helicopter, which is larger than the S-55, flew on March 8, 1954, and the first production machine on September 20, 1954. The Army and Navy versions are generally similar, differing mainly in equipment and fuel capacity. There are two commercial versions of the S-58, of which the S-58B non-scheduled passenger-freighter is similar to the H-34. The S-58C scheduled passenger-carrying version has two entrance doors on the starboard side of the cabin. First commercial deliveries of the S-58C to Sabena (8) and New York Airways (3) were made in 1956-57.

A naval HSS helicopter has been fitted experimentally with two General Electric T58 shaft turbine engines instead of its normal R-1820 piston engine, in a slightly modified nose cowling. This aircraft made its first flight on January 30, 1957, and is going into production as the HSS-2. Although weighing only a total 650 lb. (295 kg.), compared with 1,400 lb. (635 kg.) for the piston engine, the turbines give an increase of more than 400 h.p. A 17-20 seat commercial helicopter based on the HSS-2, has been projected.

TYPE.—General Purpose Helicopter.

ROTORS.—Four-blade all-metal main and tail rotors. Blades of main rotor interchangeable. Tail rotor has servo control. Main and tail rotor brakes. Main rotor disc area 2,460 sq. ft. (228.54 m.^{2}).

TRANSMISSION.—Simplified transmission system has 25% fewer parts than in previous Sikorsky designs, and provides accessory drives for the generator and its blower, the cargo hoist, primary servo control



The Sikorsky HUS-1 General Purpose Helicopter (1,525 h.p. Wright R-1820 engine).



The Sikorsky HSS-1 Helicopter powered by two General Electric T58 shaft turbines, prototype of the HSS-2.

hydraulic pump, rotor tachometer and hydraulic clutch.

FUSELAGE.—Semi-monocoque structure.

LANDING GEAR.—Conventional three-wheel undercarriage, with tail-wheel at extreme rear of fuselage. Air-oil shock absorber struts. Main wheels have rotating struts to reduce drag and weight. Tail-wheel is fully-castoring and self-centering, with an anti-swivelling lock. Main wheel tyres 11.00×12. Tail-wheel tyre 6.00×6. Toe-operated main wheel brakes. Track 12 ft. (3.66 m.). Wheelbase 28 ft. 3 in. (8.75 m.).

POWER PLANT.—One Wright R-1820-84 radial air-cooled engine, rated at 1,525 h.p. for take-off and with METO power of 1,275 h.p. for five minutes. Engine is mounted behind large clam-shell doors in nose of fuselage to allow complete accessibility from ground level. Fuel capacity is from 198 U.S. gallons (750 litres) to 307 U.S. gallons (1,164 litres) depending on model.

ACCOMMODATION.—Pilot's compartment above main cabin seats two side-by-side with dual controls. Cabin normally seats 12 passengers. Up to eight stretchers can be carried. Sliding windows of pilots' compartment removable in an emergency. Cabin and cockpit air-conditioned and sound-proofed.

DIMENSIONS.—
Main rotor diameter 56 ft. 0 in. (17.07 m.).
Fuselage length 47 ft. 2 in. (14.38 m.).
Height 14 ft. 4 in. (4.32 m.).

WEIGHTS (S-58).—
Weight empty 7,560 lb. (3,429 kg.).
Weight loaded 12,700 lb. (5,761 kg.).

WEIGHTS (H-34A).—
Weight empty 7,646 lb. (3,468 kg.).
Weight loaded 11,867 lb. (5,383 kg.).
Overload weight loaded 13,300 lb. (6,033 kg.).

PERFORMANCE (S-58).—
Cruising speed 101 m.p.h. (162 km.h.).
Rate of climb at S/L. 1,075 ft./min. (327 m./min.).
Vertical rate of climb at S/L. 600 ft./min. (183 m./min.).
Hovering ceiling with ground effect 4,000 ft. (1,220 m.).
Hovering ceiling without ground effect 2,100 ft. (640 m.).
Service ceiling 9,600 ft. (2,925 m.).
Range (with reserve) 225 miles (363 km.).

PERFORMANCE (H-34A).—
Rate of climb at S/L. 1,500 ft./min. (457 m./min.).
Vertical rate of climb at S/L. 600 ft./min. (183 m./min.).
Hovering ceiling with ground effect 9,600 ft. (2,925 m.).
Hovering ceiling without ground effect 5,500 ft. (1,675 m.).
Service ceiling 12,000 ft. (3,660 m.).

SILVAIRE

SILVAIRE AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: P.O. Box 719, FORT COLLINS, COLORADO.

President: Otis T. Massey.

The Silvaire Aircraft Corporation is manufacturing the all-metal Luscombe Model 8 Silvaire light cabin monoplane, the original prototype of which was designed and built by Don Luscombe at the Mercer Airport, Trenton, New Jersey, in 1936.

At the end of World War 2, the tooling, dies and other equipment to manufacture the Silvaire were moved by the Luscombe Airplane Corporation to Dallas, Texas, where production was resumed. In 1949, this company was purchased by the Temco Aircraft Corporation, which built about 50 Silvaires before suspending production to concentrate on military commitments.

In January, 1955, Otis T. Massey purchased the manufacturing rights and equipment for the Model 8 Silvaire from Temco and put it into production at Fort Collins, Colorado. The first aircraft off the new line flew in September, 1956.

THE SILVAIRE MODEL 8-F.

TYPE.—Two-seat Light cabin monoplane.

WINGS.—Braced high-wing monoplane. All-metal two-spar stressed-skin structure, with only two ribs in each wing. Single non-welded bracing strut each side. All-metal ailerons. Flaps optional. Total area of ailerons 14.75 sq. ft. (1.37 m.²). Gross wing area 140 sq. ft. (13.0 m.²).

FUSELAGE.—All-metal semi-monocoque structure with strengthened "safety-zone" cabin.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Trim-tab in port elevator. Areas: fin 4.72 sq. ft. (0.44 m.²), rudder 5.65 sq. ft. (0.53 m.²), tailplane 14.50 sq. ft. (1.35 m.²), elevators 8.75 sq. ft. (0.81 m.²).

LANDING GEAR.—Non-retractable tail-wheel type. Cantilever tubular-steel Vee main units with combination coil spring-oleo shock absorbers. Fully-castoring steerable tail-wheel. Wheel fairings optional. Heel-operated mechanical brakes and manual parking brake. Main wheels 600×6. Tail-wheel 6×2.00. Wheel track 6 ft. 4 in. (1.93 m.). Alternative float landing gear.

POWER PLANT.—One Continental C90 four-cylinder horizontally-opposed air-cooled engine with maximum rated power of 90 h.p. at 2,475 r.p.m. and normal cruising power of 73 h.p. at 2,300 r.p.m. Two-blade metal fixed-pitch airscrew, diameter 5 ft. 11 in. (1.80 m.). Fuel in two metal tanks in wings, each with capacity of 12.5 U.S. gallons (47.3 litres). Oil capacity 5 U.S. quarts (4.7 litres).

ACCOMMODATION.—Two seats side-by-side in cabin with dual controls. Compartment for 75 lb. (34 kg.) baggage aft of seats or alternative temporary seat for a child. Map shelf. Cabin heater and ventilators. Doors on each side of cabin with opening windows. Maximum height of cabin 3 ft. 2¾ in. (0.98 m.). Maximum width of cabin 3 ft. 3 in. (0.99 m.).

DIMENSIONS.—
Span 35 ft. (10.67 m.).
Length 20 ft. (6.10 m.).
Height 6 ft. 3 in. (1.90 m.).

WEIGHTS AND LOADINGS.—
Weight empty 870 lb. (395 kg.).
Weight loaded 1,400 lb. (635 kg.).
Wing loading 10 lb./sq. ft. (48.8 kg./m.²).
Power loading 15.6 lb./h.p. (7.07 kg./h.p.).

PERFORMANCE.—
Max. speed 128 m.p.h. (206 km.h.).
Cruising speed 120 m.p.h. (193 km.h.).
Stalling speed, flaps down 40 m.p.h. (64.4 km.h.).
Stalling speed, no flaps 48 m.p.h. (77.2 km.h.).
Rate of climb at S/L. 900 ft./min. (274 m./min.).
Service ceiling 17,000 ft. (5,180 m.).
Absolute ceiling 17,500 ft. (5,335 m.).
Take-off run 550 ft. (168 m.).
Landing run 450 ft. (137 m.).
Normal range over 500 miles (805 km.).



The Silvaire Model 8-F (90 h.p. Continental C90 engine).

STITS

STITS AIRCRAFT.

HEAD OFFICE AND WORKS: P.O. Box 3084, WEST RIVERSIDE AIRPORT, RIVERSIDE, CALIFORNIA.

Between 1948 and 1952 Mr. Ray Stits designed, built and tested his original single-seat experimental "midgets." The Stits Junior, a monoplane with a span of 8 ft. 10 in. was superseded by the Sky Baby biplane with a span of only 7 ft. 2 in. They have been respectively described by their designer as the "World's Smallest."

More recent designs are the Sky-Coupe, Playboy and Flut-R-Bug. They are intended for construction at home by amateurs and have been sold in the form of both plans and kits of prefabricated parts.

THE STITS SA-7 SKY-COUPE.

This side-by-side two-seat light aeroplane is sold in the form of kits of prefabricated parts for construction by amateurs. The steel-tube fuselage and tail surfaces are supplied completely welded, primed and ready for covering. All parts of the wooden wing assembly are pre-cut and finished, requiring only assembly. Average time to assemble and cover the complete aircraft ready to fly is said to be 140 hours.

There have been two versions of the Sky-Coupe.



The Stits SA-7 Sky-Coupe (65 h.p. Continental A65 engine).

SA-7A. Prototype, first flown in August, 1956.

SA-7B. Production version, with two doors, flaps, larger fuel tank (20 U.S. gallons = 75.7 litres) and generally cleaner lines. First kit produced in September, 1956.

The following details refer specifically to the SA-7A prototype.

TYPE. Two-seat "home assembly" monoplane.

WINGS.—Strut-braced high-wing monoplane. NACA 4412 wing section. Aspect ratio 5. Chord 5 ft. (1.52 m.). Dihedral 3°. Incidence 3°. All-wood two-spar constant-chord structure. Fabric covering. Full-span metal ailerons droop for use as landing flaps. Total area of ailerons 12 sq. ft. (1.11 m.²). Gross wing area 120 sq. ft. (11.15 m.²).

FUSELAGE.—Welded chrome-molybdenum steel-tube structure. Fabric covered.

TAIL UNIT.—Braced monoplane type. Welded chrome-molybdenum steel-tube structure. Fabric covered.

LANDING GEAR.—Fixed tricycle type. Rubber-cord shock-absorption on main wheels. Compression spring shock-absorber on nose-wheel. Industrial 4:00 × 8 steel wheels. Manually-operated mechanical brakes.

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine driving two-blade wood or metal airscrew. (Other Continental engines in the 65-90 h.p. range may be fitted in production aircraft). One 17 U.S. gallon (64.3 litres) fuel tank aft of firewall. Oil capacity 1 U.S. gallon (3.75 litres).

ACCOMMODATION.—Two seats side-by-side in enclosed cockpit, with dual controls. Width inside cabin 38 in. (96.5 cm.). Space for 30 lb. (13.6 kg.) baggage aft of seats.

DIMENSIONS.—
Span 24 ft. 4 in. (7.42 m.).
Length 17 ft. 9 in. (5.40 m.).
Height 6 ft. 3 in. (1.90 m.).

WEIGHTS (Continental A65 engine).—
Weight empty 600 lb. (272 kg.).
Weight loaded 1,080 lb. (490 kg.).

PERFORMANCE (Continental A65 engine).—
Max. speed 100 m.p.h. (160 km.h.).
Cruising speed 90 m.p.h. (145 km.h.).
Stalling speed 35 m.p.h. (56.3 km.h.).
Rate of climb at S/L. over 1,000 ft./min. (305 m./min.).
Service ceiling over 12,000 ft. (3,660 m.).
Take-off distance 300 ft. (91 m.).
Range, with reserve, 300 miles (483 km.).

THE STITS SA-6B FLUT-R-BUG.

This two-seat version of the Flut-R-Bug is produced in kit form for construction at home by amateurs. Its makers claim that it can be built, covered and assembled ready to fly in an average of 160 hours, by a person with no previous aircraft experience, using only ordinary hand tools.



The Stits SA-6B Flut-R-Bug (65 h.p. Continental A65 engine).

The aircraft is designed for easy towing on the road, with the wings detached and fastened on racks at each side of the fuselage.

The single-seat Flut-R-Bug is no longer in production, as there proved to be little demand for an aircraft with less than two seats, despite the exceptional performance of this version.

TYPE.—Two-seat "home assembly" monoplane.

WINGS.—Strut-braced mid-wing monoplane. Constant chord structure with spruce spars, plywood ribs, and fabric covering. Tubular metal bracing struts. Wing area 130 sq. ft. (12.08 m.²).

FUSELAGE.—Chrome-molybdenum steel tube framework with fabric covering.

TAIL UNIT.—Braced monoplane type. Chrome-molybdenum steel-tube structure, with fabric covering.

LANDING GEAR.—Fixed nose-wheel type. Steerable nose-wheel. Tyres 4.00 × 8, 4-ply. Spats are optional.

POWER PLANT.—Either one 65 h.p. Continental A65 or one 85 h.p. Continental C85 four-cylinder, horizontally-opposed air-cooled engine. Tubular steel mounting is standard for Continental range of engines from A65 to C90. Wooden two-blade fixed-pitch airscrew. Fuel capacity 13½ U.S. gallons (51 litres).

ACCOMMODATION. Two seats in tandem under hinged canopy. Optional canvas compartment aft of seats for 20 lb. (9 kg.) baggage.

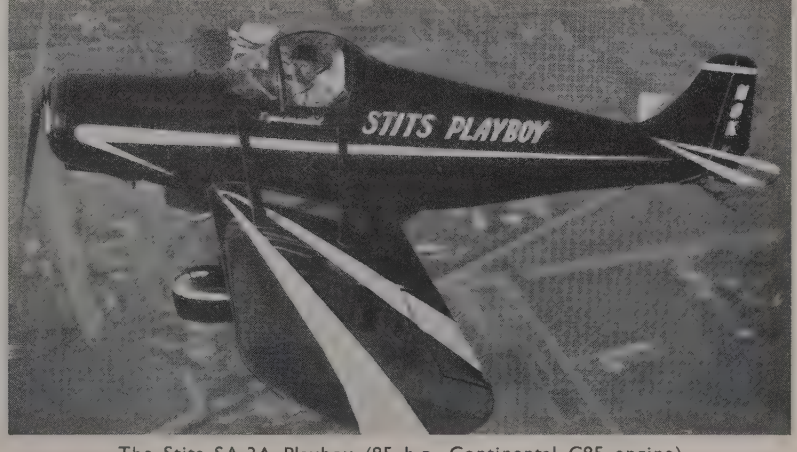
DIMENSIONS.—
Span 26 ft. (7.92 m.).
Length 18 ft. (5.49 m.).
Height 6 ft. (1.83 m.).

WEIGHTS AND LOADINGS.—
Weight empty 575 lb. (261 kg.).
Weight loaded 1,031 lb. (468 kg.).
Wing loading 7.9 lb./sq. ft. (38.57 kg./m.²).

PERFORMANCE (A65 engine).—
Max. speed 100 m.p.h. (160 km.h.).
Cruising speed 90 m.p.h. (145 km.h.).
Stalling speed (power off, 2 persons) 38 m.p.h. (61 km.h.).
Stalling speed (power off, pilot only) 32 m.p.h. (52 km.h.).
Rate of climb at S/L. over 1,000 ft./min. (305 m./min.).
Service ceiling over 12,000 ft. (3,660 m.).
Take-off distance (2 persons) 300 ft. (91 m.).
Take-off distance (pilot only) 150 ft. (46 m.).
Range over 250 miles (400 km.).

THE STITS SA-3A PLAYBOY.

The prototype of this aircraft was completed in 1953 in 390 hours of work at a total cost of under £155, and the design has been sold in the form of blueprints and pre-fabricated kits of parts for home construction. The manufacture of kits has been discontinued temporarily,



The Stits SA-3A Playboy (85 h.p. Continental C85 engine).

but plans are still available. Approximately 250 Playboys are under construction and flying throughout the world.

Normally, tubing for the construction of the fuselage and tail unit is salvaged from scrapped aircraft, as are components such as wing tie-rods and cables, pulleys, instruments, nose cowl, airscrew and engine. New spruce and plywood are specified for the wing structure.

TYPE.—Single-seat "home assembly" monoplane.

WINGS.—Strut-braced low-wing monoplane. Constant chord structure with spruce spars, plywood ribs, plywood-covered leading-edge and overall fabric covering. Steel tube bracing struts. Ailerons are of wooden construction and fabric-covered. Wing area 96 sq. ft. (8.9 m.²).

FUSELAGE.—Chrome-molybdenum steel tube framework with fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Controllable trim-tab in port elevator only.

LANDING GEAR.—Fixed tail-wheel type. Oleo shock-absorbers. Spats are optional. Leaf-spring tailwheel.

POWER PLANT.—One 85 h.p. Continental C85 four-cylinder horizontally-opposed air-cooled engine. Engine mounting standard for Continental range of engines from A65 to C90. Wooden two-blade fixed-pitch airscrew. Fuel capacity 14 U.S. gallons (53 litres).

ACCOMMODATION.—Single-seat open cockpit (enclosed hood optional). Compartment for 40 lb. (18 kg.) baggage.

DIMENSIONS.—
Span 22 ft. 2 in. (6.76 m.).
Length 17 ft. 4 in. (5.28 m.).

WEIGHTS AND LOADINGS.—
Weight empty 600 lb. (272 kg.).
Disposable load 302 lb. (137 kg.).
Weight loaded 902 lb. (409 kg.).
Wing loading 9.0 lb./sq. ft. (43.92 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

PERFORMANCE.—
Max. speed 150 m.p.h. (241 km.h.).
Cruising speed 135 m.p.h. (216 km.h.).
Stalling speed 43 m.p.h. (69 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Service ceiling over 12,000 ft. (3,660 m.).
Take-off (against 10 m.p.h. wind) 150 ft. (46 m.).

THE STITS SA-3B PLAYBOY.

This is a two-seat version of the SA-3A fitted with dual controls and an electrical system. Power is increased by installing a 150 h.p. Lycoming O-320 engine, with a total of 36 U.S. gallons (136 litres) of fuel in two tanks.

DIMENSIONS.—
Span 24 ft. 2 in. (7.37 m.).
Length 17 ft. 10 in. (5.43 m.).
Wing area 108 sq. ft. (10.03 m.²).

WEIGHTS.—
Weight empty 795 lb. (360 kg.).
Weight loaded 1,450 lb. (658 kg.).

PERFORMANCE.—
Max. speed 150 m.p.h. (241 km.h.).
Cruising speed 140 m.p.h. (225 km.h.).
Stalling speed 55 m.p.h. (89 km.h.).
Initial rate of climb over 1,000 ft./min. (305 m./min.).
Take-off distance 200 ft. (61 m.).

STROUKOFF

STROUKOFF AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: MERCER AIRPORT, WEST TRENTON, NEW JERSEY.

President and Chief Engineer: Michael Stroukoff.

Assistant Chief Engineers: L. J. Stowe and J. E. Bartfield.

Treasurer and Comptroller: J. X. Cousins.

Director of Personnel and Public Relations: R. C. Ward.

The Stroukoff Aircraft Corporation was formed by Mr. Stroukoff after the controlling interest in the Chase Aircraft Company, Inc., of which he was Vice-President and Chief Engineer, was acquired by the Kaiser-Frazer Corporation. Mr. Stroukoff was responsible for the design of the Chase C-123. A production order for 300 C-123B's held by the Kaiser-Frazer Corporation was cancelled in 1953. After new bids had been asked for, production of the C-123B was assigned to the Fairchild Engine and Airplane Corporation, to which reference should be made for a description of this aircraft.

The Stroukoff Aircraft Corporation is undertaking considerable development work with the basic C-123 design. The company was awarded a U.S.A.F. contract for the construction and development of a test version of the C-123 fitted with boundary-layer control. The first aircraft so equipped, the XC-123D, first flew on December 7, 1954. Preliminary tests at the Wright Air Development Center showed that with boundary-layer control the take-off distance of the XC-123D at 50,000 lb. (22,700 kg.) A.U.W. was reduced from 1,950 ft. (595 m.) to 850 ft. (250 m.) and the landing run from 1,200 ft. (366 m.) to 755 ft. (230 m.).

As a result of the success of the XC-123D, Stroukoff was awarded a contract to build a production development for the U.S.A.F. under the designation of YC-134, and the prototype of this aircraft flew for the first time on December 19, 1956.

Later models of the YC-134 will be fitted with the Stroukoff "pantobase" type of landing gear which is designed for operation from water, sand, swamp, snow, ice and almost any unprepared but fairly smooth natural surface.

The "pantobase" gear is being tested on a further Stroukoff development of the C-123, known as the YC-123E. Although basically a landplane, this aircraft proved itself completely amphibious early in 1956 in a stringent series of land and water tests from Palm Beach Air Force Base and on Lake Okeechobee, in water conditions approaching gale force. It was then flown to Bemidji, Minnesota, for testing under semi-Arctic conditions, during which it established a record for take-off from snow on skis.

The YC-123E took off without RATOG and without flaps at a loaded weight of 55,165 lb. (25,023 kg.), which was 5,165 lb. (2,343 kg.) more than its normal loaded weight, in surface conditions of 21 in. (53 cm.) of unpacked snow, plus drifts, at a temperature of – 8.3°C. (17°F.).

During 1956, all flight and instrumentation tests of the YC-123E were completed by the U.S.A.F.'s Wright Air Development Center Directorate of Flight and it was approved by the Air Research and Development Command.

In addition to this work on the YC-134 and YC-123E, Stroukoff made a series of studies of advanced boundary layer control developments during 1956, in the company's laboratories and wind tunnel at West Trenton.

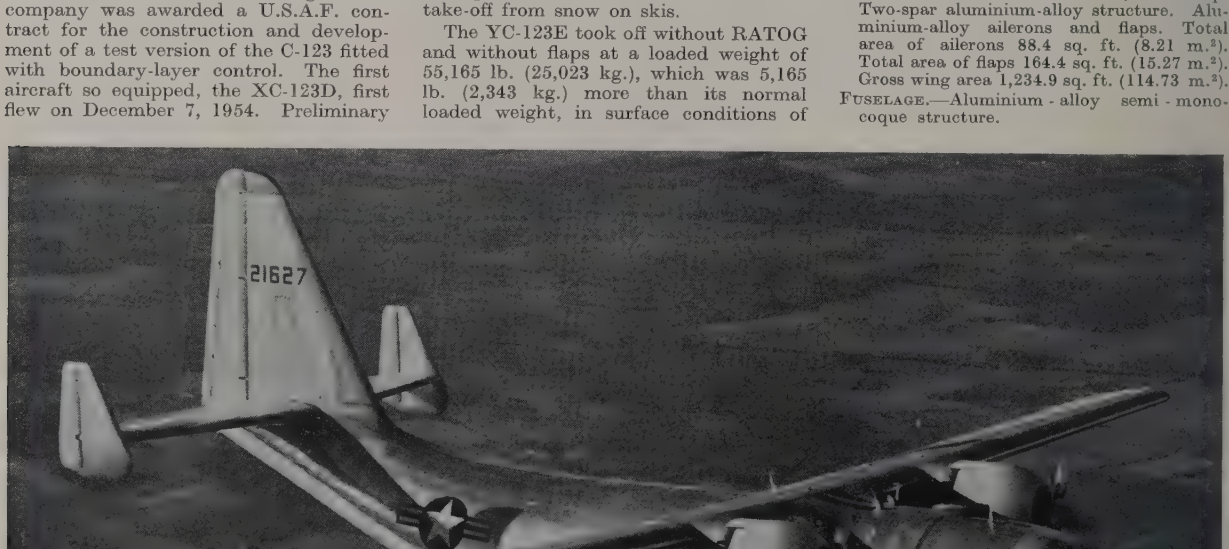
THE STROUKOFF YC-134.

The YC-134 is a development of the C-123 Provider assault transport fitted with boundary layer control. The test vehicle prototype flew on December 19, 1956 and will be followed by a pre-production batch of three YC-134A aircraft, the second and third of which will have also a Stroukoff "pantobase" landing gear as tested on the YC-123E. The following details apply to the YC-134 prototype.

TYPE.—Experimental twin-engined transport.

WINGS.—High-wing cantilever monoplane. Aspect ratio 9.8. Wing section MS8-016.64. Mean chord 11 ft. 8 in. (3.55 m.). Dihedral 1° 18′. Incidence 8° at root, 4° at tip. Two-spar aluminium-alloy structure. Aluminium-alloy ailerons and flaps. Total area of ailerons 88.4 sq. ft. (8.21 m.²). Total area of flaps 164.4 sq. ft. (15.27 m.²). Gross wing area 1,234.9 sq. ft. (114.73 m.²).

FUSELAGE.—Aluminium-alloy semi-monocoque structure.



The Stroukoff YC-134 Experimental Transport (two 3,500 h.p. Wright R-3350 Turbo Compound engines).



The Stroukoff YC-123E, on which the first "pantobase" landing-gear was tested and demonstrated.

TAIL UNIT.—Cantilever monoplane type with auxiliary fins and rudders on tips of tailplane. Aluminium-alloy structure. Areas: fins (3) 183.5 sq. ft. (17.05 m²), rudders (3) 96.6 sq. ft. (8.97 m²), elevators 126.4 sq. ft. (11.74 m²), tailplane 219.6 sq. ft. (20.4 m²). Tailplane span 39 ft. 2 in. (11.94 m.).

LANDING GEAR.—Retractable tricycle type. Cleveland Pneumatic air-oil shock-absorbers. Hydraulic retraction. Tandem-wheel main units retract into fuselage. Single nose-wheel. Goodyear aluminium-alloy amphibious type wheels. Goodyear spot brakes. Wheel track 15 ft. 10 in. (4.83 m.). Wheelbase 25 ft. 10 in. (7.87 m.).

POWER PLANT.—Two 3,500 h.p. Wright R-3350-89A Turbo Compound eighteen-cylinder two-row radial air-cooled engines, driving Aeroproducts four-blade fully-feathering constant-speed airscrews. Fuel in two centre-section tanks, each with capacity of 1,100 U.S. gallons (4,164 litres), and two under-wing drop tanks each of 550 U.S. gallons (2,082 litres). Total internal fuel capacity 2,200 U.S. gallons (8,328 litres). Oil capacity 80 U.S. gallons (302 litres).

DIMENSIONS.—
Span 110 ft. 0 in. (33.55 m.).
Length 82 ft. 0¾ in. (25.0 m.).
Height 34 ft. 0 in. (10.36 m.).

WEIGHTS.—
Weight empty, equipped 37,965 lb. (17,221 kg.).
Weight loaded 74,700 lb. (33,884 kg.).

PERFORMANCE.—
Cruising speed 219 m.p.h. (352 km.h.).
Take-off distance on land 740 ft. (225 m.).
Take-off distance on water 1,250 ft. (380 m.).
Landing distance on land 550 ft. (168 m.).
Landing distance on water 750 ft. (229 m.).
Range with 24,000 lb. (10,885 kg.) payload 1,610 miles (2,595 km.).

THE STROUKOFF YC-123E "PANTOBASE."

Based on the standard C-123 airframe (see under Fairchild), the YC-123E has its fuselage sealed for flotation and is fitted with special "pantobase" landing-gear comprising a pair of heavily-stressed retractable land and water skis and wing-tip floats. The aircraft's retractable nose-wheel landing-gear is retained for runway operation. For take-off from water the skis are lowered and at about 20 m.p.h. (32 km.h.) they surface by means of aerofoils on their sides and skim the water until flying speed is reached.

With the pantobase gear the YC-123E retains all the assault transport characteristics of the C-123B. Cruising speed is reduced by about 2 per cent., mainly by the addition of the fixed wing-tip floats.

Specification and performance are generally similar to the Fairchild-built C-123B (which see), except for the following:—

TAIL UNIT. — Semi-monocoque aluminium structure. Elevators metal-covered, rudder fabric-covered. Areas: fin 123.23 sq. ft. (11.45 m²), rudder 56.3 sq. ft. (5.23 m²), elevators 105.2 sq. ft. (9.77 m²), tailplane 204 sq. ft. (18.95 m²). Tailplane span 36 ft. 4 in. (11.07 m.).

POWER PLANT.—Airscrews are Hamilton Standard four-blade with diameter of 13 ft. 6 in. (4.11 m.).

DIMENSIONS.—
Span 110 ft. (33.55 m.).
Length 77 ft. 1 in. (23.5 m.).
Height 32 ft. 10 in. (10 m.).

WEIGHTS.—
Weight empty 33,558 lb. (15,222 kg.).
Weight loaded 54,000 lb. (24,494 kg.).

PERFORMANCE.—
Cruising speed 179 m.p.h. (288 km.h.).
Range 1,500 miles (2,415 km.).
Take-off distance on water 1,400 ft. (427 m.).
Take-off distance on land 800 ft. (245 m.).
Landing run on water 750 ft. (230 m.).
Landing run on land 1,050 ft. (320 m.).



The Stroukoff YC-123E taxying (above) and taking-off from water (below).

TAYLORCRAFT

TAYLORCRAFT, INC.

HEAD OFFICE AND WORKS: CONWAY-PITTSBURGH AIRPORT, CONWAY, PA.
President: B. J. Mauro.
Vice-President: C. G. Taylor.
Chief Engineer: J. Gilberti.
Production Manager: C. Hodgekin.
Export Manager: Howard Barnhouse.

Taylorcraft, Inc is the successor to the Taylorcraft Aviation Corporation which went bankrupt in 1946. It was reformed by Mr. C. G. Taylor, founder of the original Taylor Aircraft Company and designer of the original Cub light cabin monoplane, who acquired the assets of the defunct Taylorcraft concern at a public auction.

In 1955 Taylorcraft introduced a new form of structure for light aircraft using moulded Fiberglass as a covering for fuselage and wings as well as for the engine cowling, doors, seats, fuel tanks, instrument panel, etc. Only the rudder and elevators are fabric-covered.

This new material, which is supplied by the Owens Corning Fiberglas Corpor-

ation, combines great strength with light weight and almost complete resistance to corrosion. It will not dent, warp or tear, and presents a superfine external finish.

The first three aircraft incorporating this form of construction are the Ranch Wagon, Seabird and Topper, described below.

THE TAYLORCRAFT MODEL 20 RANCH WAGON.

TYPE.—Four-seat light cabin monoplane, quickly convertible for light cargo-carrying.

WINGS.—High-wing rigidly-braced monoplane. Wing section Göttingen 532. Aspect ratio 7.11. Dihedral 1°. Chord 6 ft. 2¼ in. (1.89 m.). Two-spar light alloy structure covered with moulded Fiberglass skin. All-aluminium slotted flaps and ailerons. Slotted wing-tips. Total area of flaps 14.3 sq. ft. (1.33 m.²)- Total area of ailerons 14.38 sq. ft. (1.36 m.²). Gross wing area 178.5 sq. ft. (16.58 m.²).

FUSELAGE.—Welded steel tube framework. Fiberglass covering is moulded in two half sections extending from fireproof bulkhead to rudder-post, including fin, and is attached directly to fuselage framework and upper and lower joints sealed.

TAIL UNIT.—Braced monoplane type. Fin integral with fuselage. Welded steel tube frames for tailplane, elevators and rudder, the tailplane covered with Fiberglass and the elevators and rudder with fabric. Areas: fin 9.35 sq. ft. (0.86 m.²), rudder 9.36 sq. ft. (0.87 m.²), tailplane 15.84 sq. ft. (1.47 m.²), elevators 13.98 sq. ft. (1.29 m.²). Span of tail 11 ft. 10⅛ in. (3.63 m.).

LANDING GEAR.—Fixed tail-wheel type. Two faired side vees and two half axles, the latter fitted with air-oil shock-absorbers. Cleveland wheels and C2000H brakes. Steerable tail-wheel. Track 6 ft. 3 in. (1.90 m.).

POWER PLANT.—One 225 h.p. Continental O-470-J six-cylinder horizontally-opposed air-cooled engine. McCauley metal fixed-pitch airscrew. Optionally Hartzell or McCauley constant-speed airscrew can be fitted. Three Fiberglass fuel tanks (22 U.S. gallons=83 litres). Total fuel capacity 66 U.S. gallons (250 litres). Oil capacity 3 U.S. gallons (11.3 litres).

ACCOMMODATION.—Enclosed cabin seats four, two in front with dual wheel controls. Individual rear seats can be instantly removed to provide cargo space. The starboard front seat alongside the pilot can also be removed and the space made available for cargo. Large baggage compartment behind rear seats. Doors on either side of front seats, and a special wide cargo door may be installed on starboard side of rear compartment.

DIMENSIONS.—
Span 34 ft. 8 in. (10.57 m.).
Length 24 ft. 4 in. (7.42 m.).
Height 7 ft. 1⅛ in. (2.16 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,625 lb. (738 kg.).
Disposable load 1,125 lb. (511 kg.).
Weight loaded 2,750 lb. (1,249 kg.).
Wing loading 15.4 lb./sq. ft. (75.15 kg./m.²).
Power loading 12.2 lb./h.p. (5.54 kg./h.p.).

PERFORMANCE (constant-speed airscrew).—
Max. speed 160 m.p.h. (256 km.h.).
Cruising speed 150 m.p.h. (240 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Cruising endurance 5 hours.



The Taylorcraft Ranch Wagon (225 h.p. Continental O-470-J engine).

THE TAYLORCRAFT SEABIRD.

The Seabird is a floatplane version of the Ranch Wagon, to which it is similar in almost all respects, except for its landing gear. This consists of two Edo Type 249-2870 floats which are made, like the skin of the airframe, from Fiberglass. It is claimed that this method of construction will reduce the possibility of damage if the floats hit drifting objects on the water.

Like the Ranch Wagon, the Seabird has a 225 h.p. Continental O-470-J engine. This normally drives a Hartzell constant-speed airscrew, but a McCauley constant-speed airscrew can be supplied as an alternative.

DIMENSIONS.—
Same as Ranch Wagon.

WEIGHTS AND LOADINGS.—
Weight empty 2,020 lb. (916 kg.).
Weight loaded 3,040 lb. (1,379 kg.).
Wing loading 17 lb./sq. ft. (83 kg./m.²).
Power loading 13.5 lb./h.p. (6.13 kg./h.p.).

PERFORMANCE.—
Max. speed 140 m.p.h. (225 km.h.).
Cruising speed 130 m.p.h. (209 km.h.).
Rate of climb at S/L. 790 ft./min. (240 m./min.).
Service ceiling 14,000 ft. (4,270 m.).
Endurance 5 hr.



The Taylorcraft Seabird (225 h.p. Continental O-470-J engine).

THE TAYLORCRAFT MODEL 20AG TOPPER.

The Topper is similar to the Ranch Wagon but is intended for agricultural use. Provision is made for the installation of a dust hopper or spray tank in the rear half of the cabin and there is a power take-off on the engine for operating a spray pump. The pilot is seated centrally in front and has stick control. There is one door on the right side of the front compartment.

The structure, power-plant and dimensions of the Topper and Ranch Wagon are identical. The Topper has two Fiberglass fuel tanks with a total capacity of 46 U.S. gallons (174 litres).

DIMENSIONS.—
Same as Ranch Wagon.

WEIGHTS AND LOADINGS.—
Weight empty 1,635 lb. (742 kg.).
Max. payload, with 44 U.S. gallons (167 litres) fuel and 3 U.S. gallons (11.3 litres) oil, 1,690 lb. (767 kg.).
Max. permissible loaded weight 3,767 lb. (1,709 kg.).
Max. wing loading 21.1 lb./sq. ft. (103 kg./m.²).
Max. power loading 16.74 lb./h.p. (7.60 kg./h.p.).

PERFORMANCE.—
Max. speed 115 m.p.h. (184 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 15,000 ft. (4,575 m.).



The Taylorcraft Topper Agricultural Duster and Sprayer.

TEMCO

TEMCO AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: P.O. Box 6191, Dallas 22, Texas.

OTHER FACTORIES: Garland and Greenville, Texas.

President: Robert McCulloch.

Executive Vice-President and Comptroller: H. L. Howard.

Vice-President: Clyde Williams.

Vice-President and General Manager, Dallas Division: J. A. Maxwell, Jr.

Vice-President, Engineering: I. Nevin Palley.

Manager of Engineering Programmes: Brig. Gen. Robert E. Galer.

Corporate Secretary: W. L. Leeds.

Temco, in addition to turning out major sub-assemblies for many of the latest U.S. military aircraft, has expanded into the prime contract field with development of the Model 51 primary jet trainer,

the XKDT-1 rocket-powered missiles target drone, and a new missile weapons system about which little information has been released.

The Model 51, designated the TT-1 by the U.S. Navy, was the first Temco-designed jet aircraft and was the first primary jet trainer to be accepted by any of the U.S. Military services.

Despite a new emphasis on design and development, Temco Aircraft's major business continues to be manufacture of sub-assemblies, plus modification and overhaul of military aircraft. Temco holds contracts for the manufacture of major components for the Boeing B-52; McDonnell F3H, F-101 and RF-101; Lockheed F-104, P2V-7, C-130 and Electra; Republic F-84F and RF-84F; North American F-100; Fairchild C-123 and for the Pratt & Whitney J57 turbojet engine.

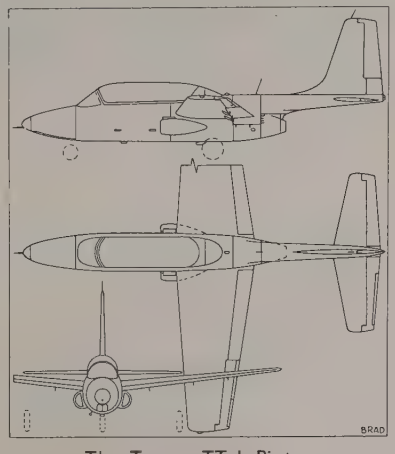
The company also continued during 1957 a varied and intensive modification and overhaul programme, largely at the Greenville plant. Military contracts included modifying of such aircraft as the Boeing C-97 and RB-50 and the Douglas C-54. In addition, the Greenville plant handles conversion of Navions into Riley Twins.

Temco also undertakes special contractural modification. One such recent job was modification of a B-57 bomber by attaching a simulated Bomarc missile nose onto its fuselage. This was done under a contract from the Boeing Airplane Company.

Temco's Dallas plant has been reorganised on a divisional basis. An expanded research and development programme brought announcement of a new 100,000 sq. ft. engineering building at the Garland plant. A new corporate headquarters building at the Garland plant also was scheduled for completion during 1957.



The Temco TT-1 Pinto Trainer (Continental YJ69 turbojet engine).



The Temco TT-1 Pinto.

THE TEMCO MODEL 51 PINTO.
U.S. Navy designation: TT-1.

The Temco Model 51 was the first primary jet trainer accepted by one of the U.S. military services. It is stressed for an ultimate load of 11.25 "g" and extra structural strength has been built into the airframe to permit eventual installation of engines with greater power than the present Continental J-69-T-9 turbojet (920 lb.=417 kg. s.t.).

Wide use has been made of new materials such as fiberglass and metal honeycomb, and standard equipment includes ejection seats, liquid oxygen breathing system, edge-lighted instrument panel and hydraulically-operated speed brakes. Fuel system tanks are interconnected to eliminate the need for fuel selection by the pilot.

The engine of the Temco Model 51 can be exposed for maintenance in ten seconds and a complete engine change can be made in 20 minutes. The outer wing panels and rear fuselage are quickly removable. Ground equipment includes an engine dolly which can also be used as a work-stand.

The prototype of the Temco 51 first flew on March 26, 1956 and was sent shortly afterwards to the U.S. Navy base at Patuxent River, Maryland, for evaluation with the Beech Model 73 Jet Mentor.

As a result of these trials, the Navy ordered a batch of 14 Model 51's, under the designation TT-1, for use by the U.S. Naval Air Training Command to "determine the feasability of beginning a student pilot's flight training in jet-propelled aircraft." Delivery was scheduled to begin in July, 1957.

Type.—Two-seat jet Primary Trainer.

Wings.—Mid-wing cantilever monoplane. Three different wing sections are used to preserve airflow over the outer wings long after the roots have stalled, to maintain aileron control well into the stall. Wing-tips are of moulded fiberglass. Some wing panels and the landing gear doors are of metal honeycomb construction. Hydraulically-operated flaps. Aileron area: 10.04 sq. ft. (0.93 m.²). Flap area: 15.65 sq. ft. (1.45 m.²). Gross wing area 150 sq. ft. (13.9 m.²).

Fuselage.—All-metal forward structure, with moulded fiberglass tail-cone. Engine intake ducts of fiberglass. Large access door in top of nose section. Air brakes at the tail comprise two panels which open out above the tailplane and a third panel which opens downward below it.

Tail Unit.—Cantilever monoplane type. All-metal except for fiberglass tailplane tips and fin tip. Areas: fin 23.5 sq. ft. (2.18 m.²), rudder 5.15 sq. ft. (0.48 m.²), tailplane 39 sq. ft. (3.62 m.²), elevator 11.6 sq. ft. (1.08 m.²). Tailplane span 13 ft. 3 in. (4.85 m.).

Landing Gear.—Retractable tricycle type. Hydraulic retraction. All units designed to extend and lock under gravity in the event of complete hydraulic failure. Wide track main units, stressed for an ultimate sinking speed of 20.4 ft./sec. (6.1 m./sec.). Oversize tyres and brakes. Wheel track 13 ft. 3½ in. (4.87 m.).

Power Plant.—One Continental YJ69-T-9 turbojet engine supplying 920 lb. (417 kg.) s.t. at sea level. Normal fuel capacity 124 U.S. gallons (468 litres).

Accommodation.—Pupil and instructor in tandem in enclosed cabin, with raised rear seat. Dual controls and instruments. Air conditioning. Ejection seats. All primary flight controls are mechanical push-rod type. Electrically-actuated trim-tabs.

Dimensions.—
Span 29 ft. 10 in. (9.09 m.).
Length 30 ft. 7 in. (9.33 m.).
Height 10 ft. 10 in. (3.30 m.).

Weight.—
Normal weight loaded 4,400 lb. (1,996 kg.).

Performance.—
Max. speed at 15,000 ft. (4,570 m.) 345 m.p.h. (556 km.h.).
Max. speed at S/L. 328 m.p.h. (528 km.h.).
Max. diving speed 518 m.p.h. (834 km.h.).
Cruising speed at 25,000 ft. (7,620 m.) 270 m.p.h. (435 km.h.).
Stalling speed at landing weight 69 m.p.h. (111 km.h.).
Stalling speed at take-off weight 76 m.p.h. (122 km.h.).
Rate of climb at S/L. 1,900 ft./min. (580 m./min.).
Service ceiling 30,000 ft. (9,145 m.).
Endurance at S/L 1.5 hours.



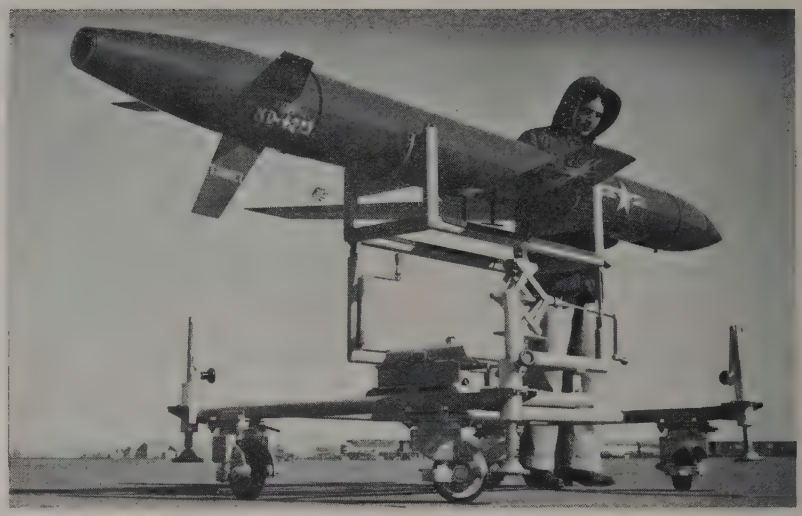
The Temco TT-1 Pinto Trainer (Continental YJ69 turbojet engine).

THE TEMCO XKDT-1 TARGET DRONE.

The XKDT-1 is a small rocket-propelled expendable target capable of a speed of Mach 0.95 at 50,000 ft. (15,250 m.) or above. It won a U.S. Navy design competition, as a result of which Temco were awarded a contract for the design, construction and flight testing of an evaluation quantity of the drones, together with launchers, check-out and handling equipment.

Intended primarily for training jet pilots and for missiles evaluation, the XKDT-1 is about 12 ft. (3.66 m.) long, with a span of 4 ft. 10¾ in. (1.49 m.) and fuselage diameter of 10 in. (0.25 m.). The vertical fin is on the underside of the fuselage, so that the target can be launched from beneath piloted aircraft. The fuselage is made of aluminium and magnesium. The sweptback wings have a honeycomb core, and the tail surfaces are machined extrusions.

The XKDT-1 will have a self-contained guidance system, and once launched it will maintain a constant course and altitude during its powered flight of more than eight minutes. Although comparable in size with operational air-to-air missiles, it will appear as large as a fighter aircraft to radar observers on the ground and to missile guidance systems. Visual tracking of the target will be made possible by ejecting flares from it intermittently during the powered phase of its flight.



The Temco XKDT-1 Target Drone.

THE TEMCO RILEY TWIN.

The Riley Twin is a conversion of the well-known four-seat Navion into a twin-engined aircraft. The first conversion was completed by the Riley Aircraft Company in April, 1952, and the type received its Approved Type Certificate early in 1953.

Conversion included installing two Lycoming engines in wing nacelles; reinforcing the original wing to support the engine nacelles; fitting a new nose to the fuselage, a new vertical tail surface and a new control pedestal and instrument panel, while there are many other changes in furnishings and equipment.

Production of the Riley Twin was begun by Temco in April, 1953, under a contract with the Riley Aircraft Company. Later, Temco fitted the Riley Twin with 150 h.p. engines in place of the original 140 h.p. power-units, and increased the aircraft's gross weight from 2,950 lb. (1,340 kg.) to 3,350 lb. (1,521 kg.).

In December, 1953, Temco purchased the exclusive engineering and conversion rights for the Riley Twin.

In 1954 Temco introduced an improved version of the Riley Twin, the prototype flying for the first time on September 1, 1954. The new conversion has 170 h.p. Lycoming engines, an all-up weight of 3,600 lb. (1,634 kg.) and wing-tip tanks which extend the range to 1,200 miles (1,920 km.). The Riley Twin is now in production at Temco's Greenville plant.



The Temco Riley Twin (two 170 h.p. Lycoming O-340 engines).

The first production aircraft flew on February 23, 1955.

TYPE.—Twin-engined four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 4415R at root, NACA 6410R at tip. Aspect ratio 4.04. Dihedral 7½°. Incidence +2° at root, —1° at tip. Chord 7 ft. 2½ in. (2.20 m.) at root, 3 ft. 10 in. (1.17 m.) at tip. All-metal structure with 24ST aluminium skin. Ailerons and flaps as for Navion. Gross wing area 178.3 sq. ft. (16.5 m.²).

FUSELAGE.—All-metal structure as for Navion except for addition of new nose.

TAIL UNIT.—Cantilever monoplane type. Tailplane and elevators as for Navion. Fin and rudder are modified versions of half of Navion tailplane and one elevator. Areas: fin 14.8 sq. ft. (1.37 m.²), rudder 10.2 sq. ft. (0.95 m.²). Other areas and tailplane span as for Navion.

LANDING GEAR.—Retractable nose-wheel type. Same as for Navion, except higher heat treatment for main air/oil shock-absorber units. Hydraulic retraction. Wheelbase 5 ft. 8½ in. (1.73 m.). Track 8 ft. 2½ in. (2.49 m.).

POWER PLANT.—Two 170 h.p. Lycoming O-340-A1A four-cylinder horizontally-opposed air-cooled engines. Hartzell constant-speed full-feathering airscrews. Main tank in centre wing section (39.5 U.S. gallons = 149 litres) and two auxiliary tanks, one in each engine nacelle (32.5 U.S. gallons = 123 litres each). Two wing-tip tanks (20 U.S. gallons = 76 litres each). Total fuel capacity 144.5 U.S. gallons (547 litres).

ACCOMMODATION.—Enclosed cabin seats four in two pairs, front pair with dual controls. Generally similar to Navion but with new control pedestal and instrument board. Baggage compartment aft of rear seats with access from cabin.

DIMENSIONS.—
Span over tip tanks 33 ft. 10½ in. (10.33 m.)
Length 27 ft. 2 in. (8.28 m.).
Height 9 ft. 6½ in. (2.90 m.).

WEIGHTS.—
Weight empty 2,350 lb. (1,067 kg.).
Weight loaded 3,600 lb. (1,634 kg.).

PERFORMANCE (at 3,600 lb. = 1,634 kg. A.U.W.).—
Max. speed 180 m.p.h. (288 km.h.).
Cruising speed (70% power) at 7,000 ft. (2,135 m.) 170 m.p.h. (272 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Service ceiling 20,000 ft. (6,100 m.).
Service ceiling on one engine 6,000-8,000 ft. (1,830-2,440 m.).
Landing speed (with flaps) 58 m.p.h. (92.8 km.h.)
Landing speed (without flaps) 62 m.p.h. (99.2 km.h.).
Take-off distance to clear 50 ft. (15.25 m.) at S/L. no wind 1,150 ft, (350 m.).
Landing distance from 50 ft. (15.25 m.) at S/L. no wind 1,050 ft. (320 m.).
Range with tip tanks (70% power) 1,200 miles (1,920 km.).

TEXAS A. & M. COLLEGE

AIRCRAFT RESEARCH CENTER, AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

ADDRESS: COLLEGE STATION, TEXAS.

A programme of research on agricultural aviation problems is being undertaken at the Aircraft Research Center of the A. and M. College of Texas. This programme, which was initiated by the National Flying Farmers Association, in co-operation with the Civil Aeronautics Administration, the Department of Agriculture and the A. and M. College of Texas, includes the development of aircraft specifically designed for dusting, spraying, seeding and fertilising, and improved dispersing equipment.

An aircraft was designed and built under a C.A.A. contract which became effective on December 7, 1949, and this aircraft, the Ag-1, made its first flight on December 1, 1950.

A modification of the Ag-1, designated the Ag-2, has been developed for commercial production by the Transland Company, of Torrance, California (which see).

In the meantime the Aircraft Research Center has developed a smaller aircraft, the Ag-3. This was sponsored by Piper Aircraft Corporation and the prototype is being evaluated at Piper's new Development Center in Vero Beach, Florida.

THE Ag-3.

The Ag-3 is an experimental aircraft which has been designed to carry a spray or dust load of 800 lb. (365 kg.) with a 135 h.p. engine. It makes use of a number of standard Piper parts. The prototype made its first flight in November, 1954.

TYPE.—Single-seat Experimental Agricultural monoplane.

WINGS.—Low-wing rigidly-braced monoplane. U.S.A. 35B wing section. Chord 5 ft. 3 in. (1.60 m.). Dihedral 6°. Incidence 2°. Metal two-spar frame with fabric covering. Total aileron area 16 sq. ft. (1.48 m.²). Gross wing area 183 sq. ft. (17.0 m.²).

FUSELAGE.—Steel tube fabric-covered structure. Removable panels on whole underside and forward portion of sides.

TAIL UNIT.—Welded steel tube framework covered with fabric. Areas: fin 4 sq. ft. (0.37 m.²), rudder 7.4 sq. ft. (0.69 m.²), tailplane 17 sq. ft. (1.58 m.²), elevators 13 sq. ft. (1.21 m.²). Span of tail 10 ft. 6 in. (3.20 m.).

LANDING GEAR.—Fixed tail-wheel type with provision for conversion to tricycle type. Oleo and rubber cord springing. Wheels, tyres and brakes same as for Piper PA-20 Pacer. Track 6 ft. 10 in. (2.07 m.²).

POWER PLANT.—One 135 h.p. Lycoming O-290 four-cylinder horizontally-opposed air-cooled engine. Sensenich one-piece metal airscrew. Fuel tank (40 U.S. gallons = 151 litres) in fuselage.

ACCOMMODATION.—Single cockpit may be either closed or open. Decking forward of cockpit slopes steeply to ensure good forward view. Headrest forms a turnover structure and guide tubes from windscreen to headrest and cable from headrest to top of fin are provided for protection against cables or wires contacted in flight. 18 cub. ft. (0.51 m.³) hopper for 800 lb. (365 kg.) load of chemical, etc. in front of cockpit, with an adjustable sliding gate and distributor beneath fuselage. Engine-driven pump delivers liquid through manifolds to outlet nozzles.

DIMENSIONS.—
Span 36 ft. 2 in. (11.03 m.).
Length 23 ft. 7 in. (7.19 m.).
Height 6 ft. 10 in. (1.88 m.).

WEIGHTS.—
Weight empty 1,035 lb. (470 kg.).
Weight loaded 2,300 lb. (1,044 kg.).

PERFORMANCE.—
Max. speed 124 m.p.h. (198 km.h.).
Take-off to clear 50 ft. (15.25 m.) with full hopper load and 10 U.S. gallons (37.8 litres) of fuel (zero wind) 920 ft. (281 m.). (Corrected to standard S/L. air).

TRANSCENDENTAL

TRANSCENDENTAL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: GLEN RIDDLE, PENNSYLVANIA,

President: William E. Cobey.

This company was formed in October, 1946, to develop and test a convertiplane designed by Mario A. Guerrieri. The first convertiplane was completed in September, 1950. This was followed by the Model 1-G which made its first free flight on July 6, 1954. On December 13, 1954, it moved into forward flight for the first time, and four days later the first attempt to tilt the rotors forward of the vertical was made successfully.

The Model 1-G was strictly a single-seat research aircraft intended to investigate the conversion problems of a convertiplane. During 1954 and 1955 it made over 100 successful flights. During these trials the Model 1-G was converted up to 90 per cent., that is, 90 per cent. of the weight was borne by the wings and only 10 per cent. by the rotors.

In July, 1955, during a test flight in which conversion was virtually complete, the friction lock on the collective-pitch stick slipped, causing the aircraft to enter a steep dive very abruptly. Although the pilot was able to initiate a recovery there was insufficient altitude in which to complete it and the aircraft contacted the Delaware River, was tripped over on to its back and was irreparably damaged.

Although the development of the Transcendental convertiplane has been mostly privately financed, considerable assistance has been forthcoming through various U.S.A.F. contracts.

In 1952 the company was awarded a contract to investigate the dynamic and structural characteristics of the rotor system. The primary purpose of these tests was to study the action of the rotors during simulated conversion. An additional contract was awarded in 1953 to investigate mechanical instability problems when tilting the rotors of the convertiplane. This contract was continued to include limited flight tests.



The Transcendental Model 2 Experimental Convertiplane.

In March, 1956 Transcendental was awarded a further contract to continue development of the convertiplane. The new Model 2 while having the same basic configuration as its predecessor, is structurally stronger, aerodynamically much cleaner and has 50 per cent. more power. The Model 2 was completed only seven months after the U.S.A.F. contract for its construction was placed.

THE TRANSCENDENTAL MODEL 2.

TYPE.—Two-seat Experimental Convertiplane.

ROTOR SYSTEM.—Two three-blade rotors mounted at tips of fixed wings are arranged to be tilted from horizontal (vertical flight) to point 6° forward of vertical (forward flight) by electric motors. Rotor diameter 18 ft. (5.49 m.). Chord of rotor blades 0.356 ft. (108 mm.). Blades have extruded 75 ST aluminium-alloy spar, 24 ST ribs, trailing-edge and skin. Rotors interconnected to ensure simultaneous tilting. Hubs fully articulated. Controls for collective and cyclic pitch run through wings and over chain and sprocket drive at tips to rotor heads. Rotor transmission from gear-box in front of engine, through spanwise shafts to bevel gearing at wing tips to rotor heads. Two-speed gear in rotor drive to give required r.p.m. for vertical and forward flight.

WINGS.—Cantilever monoplane. NACA 23015 wing section. Aluminium-alloy structure. Ailerons have metal frames and fabric covering. Gross wing area 100 sq. ft. (9.29 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Span of tail 6 ft. 4 in. (1.92 m.).

LANDING GEAR.—Fixed nose-wheel type. Transcendental air-oil shock-absorbers.

POWER PLANT.—One 250 h.p. Lycoming O-435-23 six-cylinder horizontally-opposed air-cooled engine.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side in nose of fuselage.

DIMENSIONS.—
Span of wings 22 ft. 9 in. (6.93 m.).
Overall length of fuselage 22 ft. 1 in. (6.74 m.).
Height 9 ft. 5 in. (2.86 m.).

WEIGHTS.—
Weight empty 1,579 lb. (717 kg.).
Weight loaded 2,249 lb. (1,021 kg.).

PERFORMANCE.—
No data available.

TRANSLAND

TRANSLAND COMPANY.

HEAD OFFICE AND WORKS: 2600 W. 247TH STREET, TORRANCE, CALIFORNIA.

President: George S. Wing.

Project Engineer: Nelson M. Rogers.

The Transland Company, a subsidiary of the Hi-Shear Rivet Tool Company of Los Angeles, California, has for several years been a leading manufacturer of equipment to convert surplus trainers into crop-dusting aircraft. It is now undertaking the manufacture of complete aircraft for agricultural use, its first aircraft being the Ag-2.

The Ag-2 was designed round the applicating equipment of proven Transland design. It is intended for use not only over cultivated fields but also for fire fighting (with water and fire retardant chemicals), the treatment of infested forests, the restoration of range lands by application of top dressings and the control of noxious plants.

The first prototype Ag-2 flew for the first time on October 11, 1956, and was re-engined in the Spring of 1957 with a 600 h.p. Pratt & Whitney R-1340 engine. The planned production for 1957 is 42 aircraft.

The following data apply to the Ag-2 as originally flown with 450 h.p. R-985 engine.

THE TRANSLAND Ag-2.

TYPE.—Single-seat Agricultural monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 64021 high-lift wing section. Aspect ratio 5.19 (flaps up), 5.44 (flaps down). Chord 7 ft. 10.4 in. (2.40 m.) (flaps up). Dihedral 0° (centre-section), 8° (outer panels). Incidence 4°. All-metal structure of riveted 24ST aluminium-alloy. Wing in four sections, comprising two inner sections, which contain the Fibreglass spray tanks, and two outer sections, containing the two cell-type fuel tanks. Full-span slotted flaps, the outer wing flaps with slot lips serving as ailerons. When flaps are lowered the elevators are automatically trimmed. Total area of flaps 31.4 sq. ft. (2.92 m.²). Total area of ailerons 44.8 sq. ft. (4.16 m.²). Gross wing area 321.6 sq. ft. (29.87 m.²).

FUSELAGE.—All-metal semi-monocoque structure of riveted 24ST aluminium-alloy. All internal structure is zinc-chromate primed or otherwise protected with finishes impervious to corrosive agricultural chemicals.

TAIL UNIT.—Cantilever monoplane type. All-metal construction. Areas: fin 10.36 sq. ft. (0.96 m.²), rudder 11.27 sq. ft. (1.05 m.²), tailplane 30.59 sq. ft. (2.84 m.²), elevators 26.28 sq. ft. (2.44 m.²). Tailplane span 15 ft. 2 in. (4.62 m.).

LANDING GEAR.—Fixed tail-wheel type. Vultee 51045 air/oil shock-struts. Goodrich wheels and smooth-contour tyres. Hayes hydraulic drum-type brakes. Goodrich low-pressure tail-wheel tyre. Wire cutting blades attached to shock struts. Track 10 ft. 10 in. (3.3 m.).

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 Wasp Jr. radial air-cooled engine. Hamilton Standard 6101A two-position airscrew 9 ft. (2.74 m.) diameter. Cell-type fuel tank (62.5 U.S. gallons = 236 litres) in each outer wing.

ACCOMMODATION.—Pilot's cockpit over trailing-edge of wing. Pilot's seat and shoulder harness stressed to take 40G load. If desired sliding canopy can be provided. Cockpit sealed to prevent dust or liquid penetration.

EQUIPMENT.—Dust hopper (53 cub. ft. = 1.5 m.³) an integral part of fuselage forward



The Transland Ag-2 Agricultural Monoplane (450 h.p. Pratt & Whitney R-985 engine).

of cockpit. Two non-corrosive plastic spray tanks (62.5 U.S. gallons = 236 litres each) in each inner wing. Dust dispersal through rotary gate in underside of fuselage, pattern and swath width being controlled by adjustable vanes. Spray system operated by engine-driven pump through non-corrosive external piping and spray nozzles along wing trailing-edge. Drive for dust gate agitator and spray pump taken from gear-box on engine starter pad. Simple clutch system enables pilot to actuate either dust or spray system and either system controlled by single lever.

DIMENSIONS.—
Span 42 ft. (12.8 m.).
Length 28 ft. 5 in. (8.66 m.).
Height 9 ft. 8 in. (2.95 m.).

WEIGHTS.—
Weight empty 3,200 lb. (1,453 kg.).
Pilot 180 lb. (82 kg.).
Fuel and oil 250 lb. (113 kg.).
Payload 2,370 lb. (1,076 kg.).
Weight loaded 6,000 lb. (2,724 kg.).

PERFORMANCE.—
Cruising speed (no payload) at 60% power 107 m.p.h. (171 km.h.).
Cruising speed (2,000 lb. = 908 kg. payload) at 58% power 100 m.p.h. (160 km.h.).
Landing speed (no payload), zero wind 49 m.p.h. (78.4 km.h.).
Landing speed (2,000 lb. = 908 kg. payload), zero wind 59.2 m.p.h. (94.7 km.h.).
Initial rate of climb (no payload) 700 ft./min. (213 m./min.).
Initial rate of climb (2,000 lb. = 908 kg. payload) 600 ft./min. (183 m./min.).
Take-off distance to 50 ft. (15.25 m.) no payload 450 ft. (165 m.), 1,000 lb. (454 kg.) payload 800 ft. (244 m.), 2,000 lb. (908 kg.) payload 940 ft. (286 m.).
Landing distance from 50 ft. (15.25 m.) no payload 1,000 ft. (305 m.), 1,000 lb. (454 kg.) payload 1,230 ft. (375 m.), 1,500 lb. (681 kg.) payload 1,340 ft. (409 m.), 2,000 lb. (908 kg.) payload 1,440 ft. (440 m.).

TRECKER

TRECKER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: MILWAUKEE, WISCONSIN.

President: Francis J. Trecker.

Executive Vice-President: Carl B. Wootten.

Vice-President, Production: Commander Max I. Black.

Trecker Aircraft Corporation (formerly Royal Aircraft Corporation) was formed as a wholly-owned subsidiary of the Kearney & Trecker Corporation, to assemble and distribute in North and South America the Italian Piaggio P.136 twin-engined amphibian, under the name of Trecker Royal Gull. The first aircraft of this type was assembled by Trecker in 1955.

THE TRECKER ROYAL GULL.

Royal Gull is the name under which the Piaggio P.136 is sold in North and South America by the Trecker company, in two versions as follows:—

Royal Gull. This is the standard version with two 270 h.p. Lycoming GO-480 B1B engines, corresponding with the Piaggio P.136-L-1.

Royal Gull Super 200. With 340 h.p. Lycoming GSO-480-A1A6 supercharged engines. Corresponding with the Piaggio P.136-L-2.

In each case, the hulls and wings are fabricated by Piaggio in Italy and shipped to Trecker's Milwaukee factory, where they are assembled with all American components, including Lycoming engines, Hartzell airscrews, tyres, wheels, radio and instruments.

Full details of the P.136 will be found under "Piaggio" in the Italian section of this work.

VERTOL

VERTOL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: MORTON, PENNSYLVANIA.

Chairman and President: Don. R. Berlin.

Vice-President: Harry S. Pack.

Vice-President and Secretary: Wesley R. Frysztacki.

Vice-President, Engineering: L. L. Douglas.

Vice-President, Manufacturing: William Davey.

Vice-President and Treasurer: Gareth W. Speer.

Controller: H. W. Lord.

Director of Procurement: Lewis Sinning.

Assistant to President for Public Relations: Edward J. Doherty.

The Vertol Aircraft Corporation was, prior to March, 1956, known as the Piasecki Helicopter Corporation and except for certain changes in management it continues the activities of the former company.

It has a wholly-owned subsidiary known as Vertol Aircraft Company (Canada) Ltd. at the former R.C.A.F. station on the outskirts of Arnprior, Ontario, where overhaul and servicing of R.C.A.F. H-21 and R.C.N. HUP helicopters is undertaken.

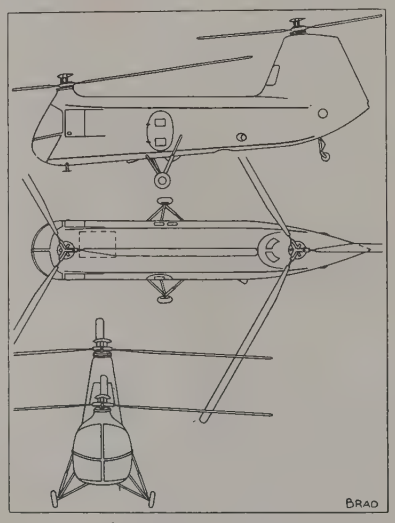
THE VERTOL RETRIEVER AND ARMY MULE.

U.S. Navy designation: HUP Retriever.
U.S. Army designation: H-25A Army Mule.

This single-engined tandem-rotored helicopter was designed to meet the requirements of the U.S. Navy for ship-board operation, including carrier plane guard duty, rescue, observation and inter-ship and ship-to-shore utility transport duties. It was required to negotiate the smallest aircraft-carrier lift without blade folding and to go down a standard cruiser aircraft lift with blades folded.

After completing an extensive Navy evaluation programme the prototype XHJP-1 was adopted by the U.S. Navy as a Fleet helicopter and a production order for twenty-two, under the designation HUP-1, was awarded to the company. Subsequently additional orders have been placed for the HUP-1 and the higher-powered HUP-2 and HUP-3 by the U.S. Navy, the Royal Canadian Navy and the French Navy, and for the H-25A by the U.S. Army. An experimental version known as the HUP-4, with a 600 h.p. (de-rated) Wright R-1300-3 engine, did not go into production.

The HUP helicopter has an all-metal soundproofed fuselage with a normal accommodation for a crew of two and



The Vertol HUP-2.

four passengers or three stretcher cases. A large loading door and ample cabin dimensions also permit the transport of a wide variety of high or low density cargo. An internally-operated rescue hatch adjacent to the pilot's seat is large enough to allow the passage of a loaded stretcher. A hydraulically-operated hoist above the hatch is used for hoisting survivors while hovering, and if a rescue sling is used the pilot can conduct the entire loading operation without assistance.

The 339th and last HUP was delivered to the U.S. Navy on July 1, 1954. The several versions of this helicopter which are in service are identified below.

HUP-1. 525 h.p. Continental R-975-34 engine. First production model. Deliveries started in 1950 and were completed in 1952.

HUP-2. 550 h.p. Continental R-975-46 engine. As the result of successful trials in automatic control in all flight conditions with the prototype XHJP-1, using a modified Sperry automatic pilot, all production HUP-2's have an auto-pilot as primary controller. This permits the elimination of the tail stabilising surfaces used in the HUP-1. Fitted with submarine-hunting sonar equipment, the HUP-2S was the first interim anti-submarine warfare helicopter to go into service. HUP-2 also used for plane guard, rescue and utility duties. Deliveries began in 1952 and were completed in 1954.

HUP-3. Medical evacuation and light cargo helicopter. U.S. Navy version of the Army H-25A.

H-25A. U.S. Army version of HUP-type. Incorporates hydraulic boost on all controls, strengthened all-metal cabin floor with cargo tie-down fittings and special modifications to facilitate loading and unloading of stretcher patients. Deliveries began in 1953 and were completed in 1954.

The following data specifically concerns the HUP-2 and H-25A.

DIMENSIONS.—
Length (rotors turning) 56 ft. 11 in. (17.3 m.).
Length of fuselage (blades folded) 32 ft. (9.75 m.).
Width (rotors turning) 35 ft. (10.7 m.).
Width (blades folded) 12 ft. 11 in. (3.91 m.).
Height (HUP-2) 13 ft. 2 in. (4.0 m.).
Height (H-25A) 12 ft. 6 in. (3.8 m.).



The Vertol HUP-2 Retriever (550 h.p. Continental R-975 engine).
(Gordon Williams).



The Vertol H-21B Shawnee (1,425 h.p. Wright R-1820 engine). (*Gordon Williams*).

WEIGHTS.—
Empty (HUP-2) 4,132 lb. (1,874 kg.).
Empty (H-25A) 3,928 lb. (1,782 kg.).
Normal loaded weight 5,750 lb. (2,608 kg.).
Max. overloaded weight 6,100 lb. (2,767 kg.).

PERFORMANCE. –
Max. speed at S/L. (normal power) over 105 m.p.h. (170 km.h.).
Cruising speed over 80 m.p.h. (130 km.h.).
Best rate of climb (normal power) 1,000 ft./min. (305 m./min.).
Vertical rate of climb (take-off power) 650 ft./min. (198 m./min.).
Service ceiling over 10,000 ft. (3,050 m.).
Max. range approx. 340 miles (630 km.).

THE VERTOL WORK HORSE.

U.S.A.F. and Army designation: H-21 Shawnee.

The H-21 Work Horse has been supplied to the U.S.A.F., U.S. Army, French Navy, Royal Canadian Air Force and the West German defence force. The German order was for 26 aircraft for which overhaul and repairs will be undertaken by the Weser company, which also holds an option to build the H-21 under licence. The H-21 exists in the following versions :—

YH-21 and H-21A. One Wright R-1820-103 engine with power limited to 1,150 h.p. Arctic rescue helicopter. Passenger-cargo compartment 20 ft. (6.08 m.) long, 5 ft. 8 in. (1.72 m.) wide and 5 ft. 6 in. (1.67 m.) high. Crew of two, pilot and co-pilot (or medical attendant), and accommodation for twelve stretchers or fourteen troops. 400 lb. (182 kg.) capacity swinging boom-type hydraulic hoist above large sliding door immediately behind pilot on starboard side for transferring loads while hovering, and further door on port side aft for loading and unloading on gound. Each wheel of landing-gear can be surrounded with inflatable ring floats to permit landing on water, marsh and land. Equipment includes cabin insulation and heating, blind-flying instruments, hydraulic control boost, external cargo sling, pilot-controlled searchlight, fixed landing light, tie-down cargo fittings in cabin floor, troop seats and stretcher supports. The Arctic Rescue version of the H-21 has demonstrated its ability to operate at temperatures down to minus 65°F.

H-21B and H-21C. One 1,425 h.p. Wright R-1820-103 engine. Troop and cargo transport capable of performing assault airlift, transport of troops and equipment, and rescue and evacuation missions for U.S. Air Force and Army. Interior and exterior dimensions and crew accommodations same as for H-21A. Cabin accommodates twelve stretchers or twenty troops. Forward door and swinging boom hoist as for H-21A but rear door larger and two extra windows added. Equipment same as for H-21A except for additional items which include autopilot, provision for jettisonable auxiliary fuel tanks, bullet-sealing fuel and oil tanks, readily-removable armour kit for protection of vital components, etc.

In August, 1957, an H-21C set up a closed circuit distance record for helicopters of 1,199.07 miles (1,929.7 km.), for which it was fitted with three additional 300 U.S. gallon (1,136 litre) fuel tanks in its cargo compartment. Another H-21C in the same month made a non-stop flight of 2,610 miles (4,200 km.) from San Diego to Washington, during which it was refuelled in flight four times by a U-1A Otter tanker aircraft, using the looped hose technique, and twice by taking on fuel whilst hovering over a ground tanker. Intended to prove the practicability of ferrying helicopters over long distances, the flight took 31 hours 40 minutes.

H-21D. Two H-21C aircraft have each been fitted with two General Electric T58 gas-turbine engines in place of a single R-1820 piston-engine, under a U.S. Navy/Army contract. Both turbines are mounted aft in such a way that the failure of one will not affect the operation of the other. Their greater power and lighter weight gives the H-21D a 40% greater payload than piston-engined versions of the H-21, together with a cruising speed of up to 150 m.p.h. (240 km.h.) and much higher hovering ceiling.

DIMENSIONS.—
Rotor diameter 44 ft. (13.42 m.).
Overall length (rotors turning) 86 ft. 4 in. (26.24 m.).
Width (blades folded) 14 ft. 4 in. (4.31 m.).
Overall height 15 ft. 5 in. (4.68 m.).

THE VERTOL MODEL 44.

The Vertol Model 44 is an improved version of the H-21 and is available in three versions.

Model 44A. Utility passenger/cargo transport. Accommodation for 19 civilian or 20 military passengers, or 12 litters and two attendants. Bulky items can be carried externally on 2½-ton cargo sling.

Model 44B. Commercial passenger transport. Seats 15 in airliner type cabin, with 50 cub. ft. (1.42 m.^{3}) mail and cargo compartment.

Model 44C. Executive transport version with custom-designed interior.

The Model 44 received its CAA Approved Type Certificate in April, 1957. Sales include two Model 44B's to the French Government and four for anti-submarine and other duties with the Swedish Navy.

TYPE.—Tandem-rotor Helicopter.

ROTOR SYSTEM.—Two three-blade rotors, one above flight deck and other at tip of up-



The Vertol Model 44 Commercial Helicopter (1,425 h.p. Wright Cyclone engine).

swept tail. Distance between hub centres 42 ft. 4 in. (12.90 m.).

ROTOR DRIVE.—By shafts, through a friction-and-jaw clutch mechanism in a central gearbox, from single engine mounted behind main cabin. Provision for full auto-rotation. Overall gearbox reduction ratio approximately 10 : 1.

FUSELAGE.—Metal semi-monocoque structure.

LANDING GEAR.—Non-retractable tricycle type. Wheel track 14 ft. 4 in. (4.37 m.). Wheelbase 24 ft. 6 in. (7.47 m.). Provision for pontoon landing gear.

POWER PLANT.—One Wright Cyclone 977C9 HD1 nine-cylinder radial air-cooled engine, developing 1,425 h.p. at 2,700 r.p.m. at 2,000 ft. (610 m.) for one minute and with a maximum cruising output of 900 h.p. at 2,400-2,500 r.p.m. Provision for fitting two shaft-turbine engines later. Normal fuel capacity 300 U.S. gallons (1,136 litres). Oil capacity 12 U.S. gallons (45.5 litres).

ACCOMMODATION.—Crew of two in forward compartment, with dual controls. Flight deck and main cabin provided with sound-proofing, heating and ventilation. Cabin arrangements as detailed above under individual Models. Maximum cabin dimensions: length 20 ft. (6.10 m.), width 5 ft. 8 in. (1.73 m.), height 5 ft. 6 in. (1.68 m.). Cabin volume approximately 600 cub. ft. (17 m.³). Door at each end of cabin. Rear door has built-in passenger steps and handrail. Larger oval windows on Model 44B.

DIMENSIONS.—
Rotor diameter (each) 44 ft. 0 in. (13.41 m.).
Overall length 86 ft. 4 in. (26.3 m.).
Fuselage length 52 ft. 6 in. (16.0 m.).
Overall height 15 ft. 5 in. (4.70 m.).

WEIGHTS.—
Weight empty 8,655 lb. (3,926 kg.).
Weight loaded (civil) 14,000 lb. (6,350 kg.).
Weight loaded (military) 15,000 lb. (6,805 kg.).

PERFORMANCE (at 14,000 lb. = 6,350 kg. A.U.W.).—
Max. speed at S/L 127 m.p.h. (204 km.h.).
Cruising speed 101 m.p.h. (163 km.h.).
Max. rate of climb at S/L 1,050 ft./min. (320 m./min.).
Hovering ceiling in ground effect 5,000 ft. (1,525 m.).
Hovering ceiling out of ground effect 3,500 ft. (1,065 m.).
Range, with reserves, 362 miles (584 km.).

THE VERTOL 76.

In the Spring of 1956 it was announced that a contract had been awarded to Vertol by the Office of Naval Research and the U.S. Army for the design and development of a turbine-powered tilting-wing vertical take-off and landing (VTOL) research aircraft, known as the Vertol 76.

This aircraft was completed in April, 1957, when it began an extensive programme of ground and flight testing.

Vertol have adopted the flying test-bed approach in developing this aircraft, by which means it will be possible to explore the characteristics of the tilting wing with a relatively inexpensive aircraft in considerably less time than is needed to design and construct a prototype.



Two views of the Vertol 76 VTOL Research Aircraft with its tilting wing in its two extreme positions.

The Vertol 76 is powered by a single Lycoming T53 turboprop geared to drive two rotor-airscrews mounted on a tiltable wing, and has two ducted fans mounted vertically and horizontally in the tail section to provide additional control. With the wing in the vertical position the rotor airscrews will provide vertical lift as in a helicopter. For cruising and high speed flight the wing will be in the normal horizontal position with the wing providing the lift and the rotor-airscrews the forward thrust. The transition from vertical lift to forward flight will be accomplished by tilting the wing-airscrew combination forward.

In addition, the wing can be set at an angle between the two extremes for short take-off and landing with higher payload than for vertical flight.

The announcement of this contract was made only a few months after the expansion of Vertol's research and development activities and their re-organisation into a single Research and Preliminary Design Department under the direction of Lee L. Douglas, Vice-President of Engineering.

DIMENSIONS.—
Span 25 ft. (7.62 m.).
Wing Chord 5 ft. (1.52 m.).
Rotor-airscrew diameter 9 ft. 6 in. (2.90 m.).

YUGOSLAVIA

GOVERNMENT FACTORIES

The Yugoslav aircraft industry consists essentially of a central national research, design and prototype manufacturing and testing establishment, and a number of purely production factories.

Before the war the Yugoslav aircraft industry was made up of three main firms, Ikarus A.D. with factories at Novi Sad and Zemun; Prva Srpska Fabrika Aeroplana Zivojin Rogojarsky with a factory at Belgrade; and Fabrika Aeroplana i Hidroplana "Zmaj" with a factory at Zemun. All these factories, in addition to building aircraft of various types under licence, including the Potez 25, Hawker Fury, Bristol Blenheim, Dewoitine D.27, Gourdou-Leseurre B.3 and Hanriot training aircraft, produced a variety of types of original design, most of which were illustrated and described in the inter-war editions of "All the World's Aircraft."

During the German occupation all these factories were destroyed and it was not until 1945 that the Ikarus plant at Zemun was sufficiently rebuilt and re-equipped to be able to resume aircraft work. As a nationalised plant it began with the repair and overhaul of YaK-3, YaK-9 and IL-2 Stormovik aircraft belonging to the Sovietised Yugoslav Air Force.

In August, 1946, the remnants of the former Ikarus, Rogojarsky and "Zmaj" companies and their surviving technical staffs were incorporated in the national concern and the design and manufacture of aircraft was resumed.

The first post-war aeroplane of original design was the Aero-2 designed by Engineers Cijan and Petkovic, a two-seat trainer, the prototype of which first flew in October, 1946. This aircraft, which was produced in quantity for the Yugoslav Air Force, was developed through various versions with differing power-plants.

At about the same time the C-3, designed by Cijan and Petkovic, won a competition for a light trainer suitable for use by national flying clubs and schools and was also put into production.

Before the break with the Cominform the only military aircraft built in Yugoslavia were of Russian design. The Ilyushin Il-2 was built in series, and trainer versions of the Il-2 and Yak-3 were also developed and built.

Since the break, however, Yugoslavia has undertaken the design and construction of its own military aircraft. The first example was the S-49, a redesign of the Yak-9 by Sivčev, Zrnic and Popovic. This aircraft has been developed through the S-49A fitted with the Russian VK-105 copy of the Hispano-Suiza 12Y engine, to the S-49C which is powered by the French-built Hispano-Suiza 12Z of greater power.

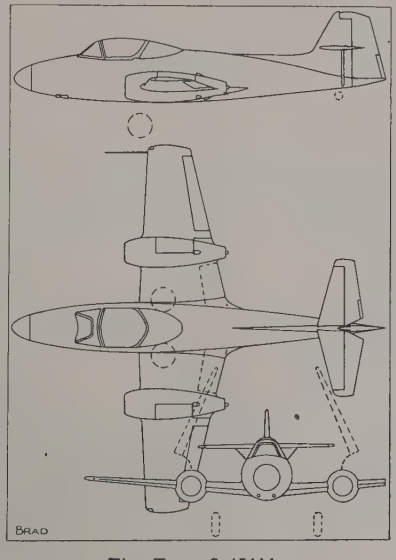
Two other types produced in 1951 were the Type 214 designed by Eng. Prof. Milutinovic and the Type 215, designed by Eng. Stankov, both twin-engined aircraft intended for training and general purpose duties. The former was selected for production for the Air Force as an aircrew trainer.

A 1949 prototype, the Type 213 two-seat advanced trainer, has been modified and fitted with a 600 h.p. Pratt & Whitney Wasp engine, and as the Type 522 has been put into production.

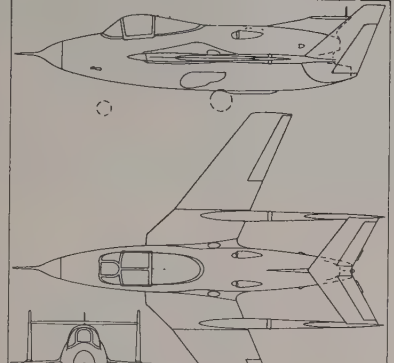
Interesting prototypes built at Zemun, near Belgrade, include the Pionir, a small research monoplane for experiments with a prone pilot position; the Type 451, a larger development of the Pionir; the Type 451-M, which was Yugoslavia's first jet-propelled aircraft; the Type S-451M trainer development; and the Type 452-2 experimental jet aircraft of novel configuration.



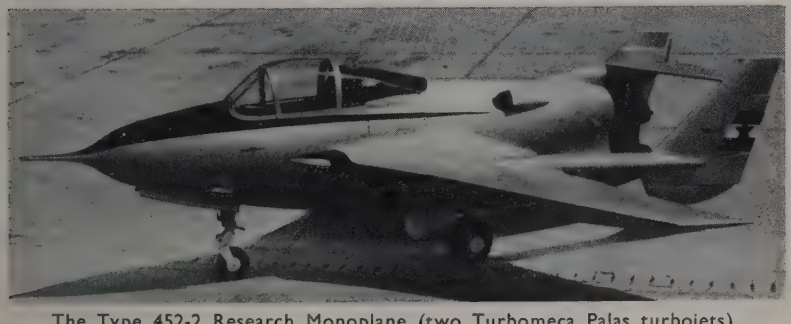
The Type S-451M Trainer (two Turbomeca Palas turbojet engines).



The Type S-451M.



The Type 452-2.



The Type 452-2 Research Monoplane (two Turbomeca Palas turbojets).

THE IKARUS B-12.

The Ikarus B-12 is a single-seat light-weight fighter which has been designed to a Yugoslav Air Force specification. It is powered by a Bristol Orpheus BOr.2 turbojet (2,050 kg.=4,520 lb. s.t.).

THE TYPE S-451M.

TYPE.—Single-seat Jet Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Centre-section integral with fuselage. Outer wing sections hinged to fold upward.

FUSELAGE.—All-metal semi-monocoque structure in three sections.

TAIL UNIT.—Fin integral with fuselage. Rudder and elevators are statically and aerodynamically balanced. Trim-tabs in elevators.

LANDING GEAR.—Retractable tail-wheel type. Oleo shock-absorbers. Goodyear tyres.

POWER PLANT.—Two Turbomeca Palas turbojet engines (150 kg.=330 lb. s.t. each) mounted at extremities of centre-section. Outer halves of cowlings attached to outer wing sections so that when latter are hinged upward engines are exposed for maintenance or engine change.

ACCOMMODATION.—Single enclosed cockpit in forward fuselage.

DIMENSIONS.—
Span 6.7 m. (21 ft. 7 in.).
Length 6.8 m. (22 ft.).
Height 2.3 m. (7 ft. 7 in.).
Wing area 8.0 m.² (86.08 sq. ft.).

WEIGHT.—
Loaded 1,202 kg. (2,644 lb.).

PERFORMANCE.—
Max. speed 459 km.h. (284.5 m.p.h.).
Min. speed 153 km.h. (94.8 m.p.h.).
Service ceiling 8,550 m. (28,045 ft.).
Range 392 km. (233 miles).
Take-off run 600 m. (656 yds.).
Landing run 582 m. (616 yds.).

THE TYPE 452-2.

The 452-2 is a single-seat research aircraft with swept wings and tail surfaces and is powered by two Turbomeca Palas turbojets mounted one above the other at the rear of the fuselage. The vertical tail surfaces are mounted at the ends of twin booms, with the Vee tailplane in between the fins and supported at its centre by a dorsal fin on the aft end of the fuselage. Separate air inlets are provided for the two engines; in the wing roots for the lower engine and on

the side of the rear fuselage for the upper engine. The landing-gear is a retractable tricycle.

An experimental light alloy is used for the whole structure.

DIMENSIONS.—
Span 5.25 m. (17 ft. 2 in.).
Length 5.97 m. (19 ft. 7 in.).
Height 1.77 m. (5 ft. 9 in.).

LOADED WEIGHT.—
1,100 kg. (2,420 lb.).

PERFORMANCE (Estimated).—
Max. speed 750 km.h. (466 m.p.h.).
Min. speed 190 km.h. (118 m.p.h.).
Duration 75 min.

THE TYPE 522.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal two-spar stressed-skin structure.

FUSELAGE.—Oval section all-metal structure in two sections, forward section of a girder type, rear section a semi-monocoque.

TAIL UNIT.—Cantilever monoplane type.

LANDING GEAR.—Tail-wheel type. Main wheels retract forward into fairings at the wing roots. Hydraulic retraction. Hydraulic wheel brakes. Non-retracting tail-wheel.

POWER PLANT.—One 600 h.p. Pratt & Whitney R-1340 AN-1 Wasp nine-cylinder radial air-cooled engine.

ACCOMMODATION.—Tandem seats under a continuous canopy with sliding sections over each cockpit.

ARMAMENT.—Two 7.9 mm. MG-15 machine-guns and four 25 kg. (55 lb.) or four 50 kg. (110 lb.) bombs. There is also provision for two 5-in. HVAR-5 rockets.

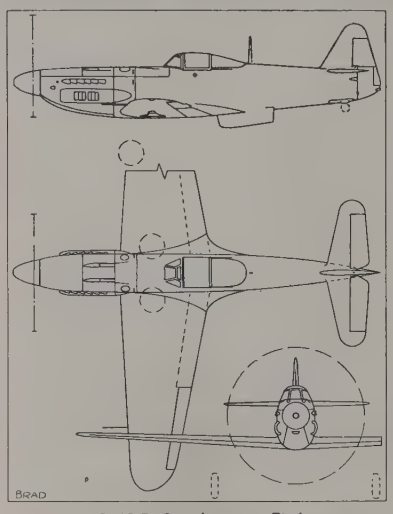
DIMENSIONS.—
Span 11.0 m. (36 ft.).
Length 9.2 m. (30 ft. 2 in.).
Height 3.58 m. (11 ft. 9 in.).

WEIGHT.—
Loaded 2,400 kg. (5,280 lb.).

PERFORMANCE.—
Max. speed 351 km.h. (218 m.p.h.).
Min. speed 135 km.h. (83.7 m.p.h.).
Service ceiling 7,000 m. (22,960 ft.).
Range 978 km. (603 miles).
Take-off run 428 m. (468 yds.).
Landing run 566 m. (618 yds.).



The Type 522 Advanced Trainer (600 h.p. Pratt & Whitney R-1340 engine).



The S-49C Single-seat Fighter.



The Aero-2 Trainer (145 h.p. D.H. Gipsy Major 10 engine).

THE S-49C.

TYPE.—Single-seat Fighter.

WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure.

FUSELAGE.—Welded steel tube structure.

TAIL UNIT.—Cantilever monoplane type.

LANDING GEAR.—Retractable tail-wheel type. Main wheels retract inwardly into wings, tail-wheel backward into fuselage.

POWER PLANT.—One 1,500 h.p. Hispano-Suiza 12Z twelve-cylinder vee liquid-cooled engine driving a three-blade airscrew. Radiator under fuselage aft of wings.

ACCOMMODATION.—Enclosed cockpit with sliding canopy. Bullet-proof windscreen and armour plate protection.

ARMAMENT.—Two 12.7 mm. machine-guns in top cowling and one 20 mm. cannon firing through the airscrew hub.

DIMENSIONS (Approx.).—
Span 9.45 m. (31ft.).
Length 8.5 m. (28 ft.).
Height 2.9 m. (9 ft. 6 in.).

WEIGHT LOADED (Approx.).—
3,400 kg. (7,500 lb.).

PERFORMANCE.—
Max. speed over 620 km.h. (384.5 m.p.h.).
Service ceiling 10,000 m. (32,800 ft.).

THE AERO-2.

TYPE.—Two-seat Primary Trainer or Army Co-operation monoplane.

WINGS.—Low-wing cantilever monoplane. Centre-section integral with fuselage, outer sections detachable. All-wood two-spar plywood-covered structure.

FUSELAGE.—All-wood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane are wood-framed with plywood covering, rudder and elevators have wood frames and fabric covering.

LANDING GEAR.—Fixed tail-wheel type. Single-strut cantilever shock struts of Ikarus design. Wheel-brakes. Steerable tail-wheel.

POWER PLANT (sub-types B and BE).—One 145 h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine.

POWER PLANT (sub-types C, D and F).—One 160 h.p. Walter Minor 6/III six-cylinder in-line inverted air-cooled engine.

ACCOMMODATION.—Tandem cockpits, open in sub-types B, C and F, or beneath transparent canopy with sliding sections over cockpits in sub-types BE and D. Dual controls.

DIMENSIONS.—
Span 10.5 m. (34 ft. 5 in.).
Length 8.45 m. (27 ft. 8½ in.).
Height 2.7 m. (8 ft. 10 in.).

WEIGHT.—
Loaded 996.5 kg. (2,192 lb.).

PERFORMANCE.—
Max. speed 208 km.h. (129 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Service ceiling 4,500 m. (14,760 ft.).
Range 680 km. (420 miles).

THE AERO-3.

TYPE.—Two-seat Primary Trainer or Army Co-operation monoplane.

WINGS.—Low-wing cantilever monoplane. Structure as for Aero-2.

FUSELAGE.—As for Aero-2.

TAIL UNIT AND LANDING GEAR.—Similar to Aero-2.

POWER PLANT.—One 185 h.p. Lycoming six-cylinder horizontally-opposed air-cooled engine.

ACCOMMODATION.—Tandem cockpits with dual controls beneath one-piece transparent sliding canopy.

DIMENSIONS.—
Same as Aero-2 except:
Length 8.58 m. (28 ft. 1 in.).

WEIGHT.—
Loaded 1,198 kg. (2,646 lb.).

PERFORMANCE.—
Max. speed 230 km.h. (142.6 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Service ceiling 4,300 m. (14,100 ft.).
Range 680 km. (422 miles).

THE KURIR DM-6R.

TYPE.—Two/three-seat monoplane designed for Army liaison, ambulance duties and parachute training.

WINGS.—High-wing cantilever monoplane. All-metal structure. Electrically-operated high-lift Fowler-type flaps inboard of ailerons. Leading-edge slots ahead of ailerons.

FUSELAGE.—All-metal structure.

TAIL UNIT.—Metal frames with fabric covering. Single bracing strut between tailplane and fin.

LANDING GEAR.—Fixed type of Ikarus construction. Long-stroke oleo shock-absorber struts. Wheel brakes. Wheels can be replaced by skis.



The Aero-3 Trainer (185 h.p. Lycoming engine).

POWER PLANT.—One 155 h.p. DM-6R six-cylinder in-line inverted air-cooled geared engine of Yugoslav design. Engine fitted with air filter for use on primitive air-strips. Two-blade Scinteks constant-speed airscrew of Yugoslav design.
ACCOMMODATION.—Enclosed cabin normally seating two but an optional third seat may be provided. Rear seat or seats removable to provide room for two stretchers. Equipment includes SCR-27HN radio and ADF-12 radio compass.
DIMENSIONS.—
Span 14.9 m. (49 ft.).
Length 9.68 m. (31 ft. 9 in.).
Height 2.5 m. (8 ft. 2½ in.).
WEIGHT.—
Loaded (two-seater) 1,400 kg. (3,080 lb.).
PERFORMANCE.—
Max. speed 189 km.h. (115 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Min. speed 59.5 km.h. (36.8 m.p.h.).
Service ceiling 3,300 m. (10,825 ft.).
Range 760 km. (470 miles).
Take-off distance to 15 m. (50 ft.) 220 m. (240 yds.).
Landing distance from 15 m. (50 ft.) 100 m. (109 yds.).



The Kurir DM-6R (155 h.p. DM-6R engine).

THE TYPE 214-D.

TYPE.—Twin-engined Bombing and Aircrew Trainer.
WINGS.—Low-wing cantilever monoplane. All-wood two-spar plywood-covered structure. Dihedral outboard of engine nacelles.
FUSELAGE.—Oval section all-wood plywood-covered structure.
TAIL UNIT.—Braced monoplane type with twin fins and rudders. Fixed surfaces have wood frames and plywood covering, movable surfaces have metal frames and are covered with fabric.
LANDING GEAR.—Retractable type. Main wheels retract backwards into engine nacelles, leaving part of wheels projecting. Fixed tail-wheel.
POWER PLANT.—Two 600 h.p. Pratt & Whitney R-1340-AN-1 nine-cylinder radial air-cooled engines.
ACCOMMODATION.—Enclosed cockpit seating two side-by-side over leading-edge of wings. Bomb-aimer's position in nose with observation windows and optically flat aiming panel. Cabin aft of pilot's compartment for navigator, radio-operator or 6-8 pupils.
DIMENSIONS.—
Span 16.2 m. (53 ft. 1½ in.).
Length 11.2 m. (36 ft. 9 in.).
Height 3.95 m. (12 ft. 11 in.).
WEIGHT.—
Weight loaded 5,027 kg. (11,059 lb.).
PERFORMANCE.—
Max. speed 365 km.h. (226 m.p.h.).
Service ceiling 7,000 m. (22,960 ft.).
Range 1,080 km. (670 miles).
Take-off run 300 m. (328 yds.).
Landing run 450 m. (492 yds.).

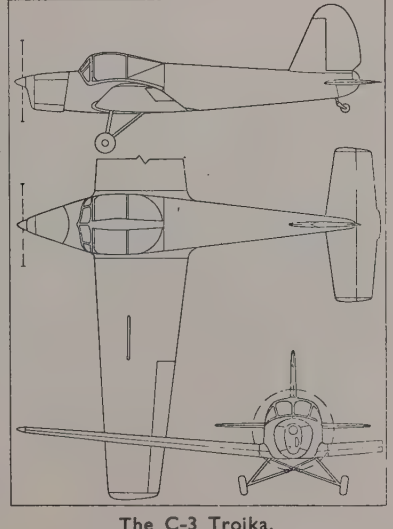


The Type 214-D Bombing and Aircrew Trainer (two 600 h.p. Pratt & Whitney R-1340 engines).

THE Fa-2 AMPHIBIAN.

The Fa-2 was designed by Mr. Fizir to meet the requirements of the Horvat Aviation Association for a small amphibian suitable for passenger work along the Yugoslav coast. To simplify construction by small companies, it is built mainly of wood. The prototype was last reported to be nearing completion in 1955.

TYPE.—Four-seat Amphibian.
WINGS.—Cantilever high-wing monoplane. Aspect ratio 6.5. All-wood two-spar structure. Centre-section is integral with fuselage. Leading-edge plywood-covered. Remainder of wing fabric-covered. Wing area 22 m.² (236.72 sq. ft.).
FUSELAGE.—Two-step hull of wooden construction with plywood covering.
TAIL UNIT.—Cantilever monoplane type with tailplane mid-set on fin to provide water clearance at take-off. Wooden structure. Fin and tailplane plywood-covered. Rudder and elevators fabric-covered.
LANDING GEAR.—Main landing gear units partially-retractable, above water level, when aircraft is afloat. Two fixed floats under wings.
POWER PLANT.—One 195 h.p. Lycoming O-435A six-cylinder horizontally-opposed air-cooled engine driving pusher airscrew.
ACCOMMODATION.—Enclosed cabin for four persons.
DIMENSIONS.—
Span 12.0 m. (39 ft. 4 in.).
Length 8.34 m. (27 ft. 4 in.).
WEIGHTS AND LOADINGS.—
Weight empty 800 kg. (1,760 lb.).
Weight loaded 1,250 kg. (2,750 lb.).
Wing loading 56.8 kg./m.² (11.63 lb./sq. ft.).
Power loading 6.4 kg./h.p. (14.08 lb./h.p.).
PERFORMANCE (estimated).—
Max. speed 205 km.h. (127 m.p.h.).
Cruising speed 175 km.h. (108.5 m.p.h.).
Landing speed 90 km.h. (55.8 m.p.h.).
Ceiling 3,000 m. (9,840 ft.).
Range 550 km. (341 miles).



The C-3 Trojka.

THE C-3 TROJKA (THREE).

TYPE.—Two-seat Light monoplane.
WINGS.—Low-wing cantilever monoplane. Single-spar all-wood structure. Detachable wing-tips. Spoiler-type slatted air-brakes on top surfaces hinge downward into slots aft of main spar when not in use. Wing area 15.5 m.² (166.8 sq. ft.).
FUSELAGE.—All-wood structure in two main portions with joint aft of cabin. Rear fuselage a pure monocoque.
TAIL UNIT.—Cantilever monoplane type. All-wood structure. Single-piece tailplane and elevator. Detachable fin and horn-balanced rudder. Trim-tab in centre of elevator.
LANDING GEAR.—Split type. Two hinged side vees and two half axles with rubber cord springing at inner ends of axles. Swivelling tail-wheel.
POWER PLANT.—One 60 h.p. Walter Mikron II four-cylinder in-line inverted air-cooled engine on steel-tube mounting. Two-blade fixed-pitch airscrew. Fuel tank aft of seats. Oil tank in engine compartment.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Cabin top is divided on fore-and-aft centre-line and each curved side section slides aft for access to both seats.
DIMENSIONS.—
Span 10.5 m. (34 ft. 5 in.).

Length 8.85 m. (29 ft.).
Height 2.10 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 374.7 kg. (824.3 lb.).
Weight loaded 603.7 kg. (1,328.1 lb.).
Wing loading 39.0 kg./m.² (7.99 lb./sq. ft.).

PERFORMANCE.—
Max. speed 161 km.h. (100 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Min. speed 73.6 km.h. (45.7 m.p.h.).
Landing speed (with air-brakes) 65 km.h. (40.4 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 10.3 min.
Service ceiling 3,900 m. (12,790 ft.).
Range 590 km. (376 miles).
Take-off run 177 m. (193 yds.).
Landing run (with air-brakes) 215 m. (235 yds.).

THE KB-6 MATAJUR.

The KB-6 Matajur was designed by the Letalski Konstrukcijski Biro, a design group of the High Technical School in Ljubljana. Responsible for the design and its subsequent development are Dusan Cener, Stane Grcar, Natan Bernot and Vital Kovacic.

TYPE.—Two-seat Trainer and Tourer.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 8. Taper ratio 0.5. Dihedral 5° 50'. Wood structure with one main spar. Plywood covering over leading-edge, fabric over remainder. Auxiliary spar carries flaps and statically and aerodynamically balanced ailerons. Flap area 1.42 m.² (15.3 sq. ft.). Total aileron area 1.38 m.² (14.8 sq. ft.). Gross wing area 14.0 m.² (150.7 sq. ft.).

FUSELAGE. — All - wood semi - monocoque structure.



The KB-6 Matajur (136 h.p. Régnier 4L00 engine).

TAIL UNIT.—Cantilever monoplane type. Fixed surfaces are all wood. Aerodynamically balanced elevators and rudder have wood frames and fabric covering. Starboard elevator has trim-tab controllable from cockpit.

LANDING GEAR.—Fixed tail-wheel type. Spring oil shock-absorbers. Steerable tail-wheel. Hydraulic wheel brakes. Track 2.5 m. (8 ft. 2 in.).

POWER PLANT.—One 136 h.p. Régnier 4L00 four-cylinder in-line inverted air-cooled engine on steel-tube bearers. Two-blade fixed-pitch wood airscrew, 1.95 m. (6 ft. 5 in.) diameter. Aluminium fuel tank (141 litres = 37.2 Imp. gallons) in fuselage behind seats. Oil tank 9 litres (2.4 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Adjustable seats. Baggage compartment aft of seats. Full electrical equipment. Glider towing hook. Touring version has upholstered cabin.

DIMENSIONS —
Span 10.6 m. (34 ft. 9 in.).
Length 8.36 m. (27 ft. 5 in.).
Height 2.15 m. (7 ft. 1 in.).

WEIGHTS AND LOADINGS.—
Weight empty 659 kg. (1,453 lb.).
Crew (2) with parachutes 180 kg. (397 lb.).
Fuel and oil 110 kg. (234 lb.).
Baggage 30 kg. (66 lb.).
Weight loaded 979 kg. (2,159 lb.).
Wing loading 70 kg./m.² (14.3 lb./sq. ft.).
Power loading 7.2 kg./h.p. (15.8 lb./h.p.).

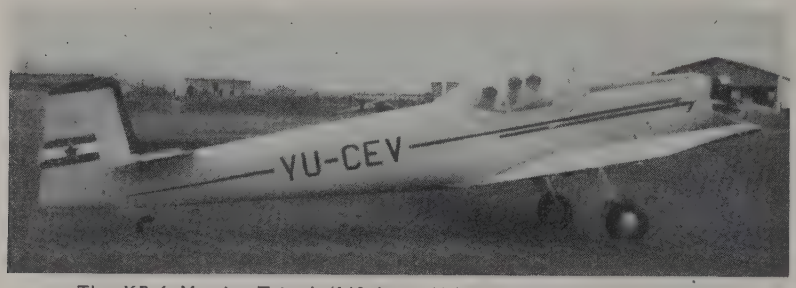
PERFORMANCE.—
Max. speed at S/L. 222 km.h. (138 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Min. speed with flaps 88 km.h. (55 m.p.h.).
Initial rate of climb 215 m./min. (689 ft./min.).
Service ceiling 4,500 m. (14,800 ft.).
Range 820 km. (510 miles).

THE KB-6 MATAJUR-TRISED.

The Matajur-Trised is a three-seat version of the previously-described model. This version is powered by a 160 h.p. Yugoslav-built Walter Minor JW-6-III six-cylinder inverted air-cooled engine.

DIMENSIONS.—
Same as for KB-6 two-seater.

WEIGHTS AND LOADINGS.—
Weight empty 710 kg. (1,562 lb.).
Weight loaded 1,150 kg. (2,530 lb.).
Wing loading 82.2 kg./m.² (16.63 lb./sq. ft.).
Power loading 7.18 kg./h.p. (15.79 lb./h.p.).



The KB-6 Matajur-Trised (160 h.p. Walter Minor JW-6-III engine).

PERFORMANCE.—
Max. speed at S/L. 230 km.h. (143 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 220 km.h. (137 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Min. speed with flaps 90 km.h. (56 m.p.h.).
Rate of climb at S/L. 150 m./min. (492 ft./min.).
Service ceiling 3,500 m. (10,480 ft.).
Range 650 km. (405 miles).
Take-off distance to clear 15 m. (50 ft.) 450 m. (492 yds.).

THE LK-1.

The LK-1 has been built in the Letov aircraft factory at Ljubljana. It was first conceived as a two-seater with a 100 h.p. engine but the design was changed during construction to its present form as a four-seater with a 160 h.p. engine. The prototype first flew on January 5, 1955.

DESIGNER.—Prof. Dr. Eng. A. Kuhelj.

TYPE.—Four-seat Tourer, also suitable for use as an Ambulance, Glider-tug, Agricultural aircraft, etc.

WINGS.—High-wing strut-braced monoplane. NACA 2415 wing section. Two-spar wood structure covered with plywood and fabric. Flaps inboard of ailerons. Ailerons and flaps are of wood with fabric covering. Gross wing area 17.5 m.² (188 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Braced monoplane type. Adjustable tailplane. Welded steel-tube framework covered with fabric.

LANDING GEAR.—Fixed split-axle type. Rubber-in-compression springing. Steerable tail-wheel.

POWER PLANT.—One 160 h.p. Yugoslav Walter Minor JW-6-III six-cylinder in-line inverted air-cooled engine. Two-blade fixed-pitch wood airscrew. Two fuel tanks, one in each wing, with a total capacity of 132 litres (29 Imp. gallons). Two reserve fuel tanks under front seats with a total capacity of 54 litres (12 Imp. gallons). Oil tank (15 litres = 3.3 Imp. gallons) behind fire-wall.

ACCOMMODATION.—Enclosed cabin seating four in two pairs, front pair with dual controls. Two doors. One-piece moulded Plexiglas windshield.

DIMENSIONS.—
Span 11.30 m. (37 ft.).
Length 7.5 m. (24 ft. 7 in.).
Height (tail down) 2.20 m. (7 ft. 2½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 690 kg. (1,518 lb.).
Weight loaded 1,190 kg. (2,618 lb.).
Wing loading 68 kg./m.² (13.94 lb./sq. ft.).
Power loading 7.5 kg./h.p. (16.5 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 190 km.h. (119 m.p.h.).
Cruising speed at 1,000 m. (3,280 ft.) 150 km.h. (93 m.p.h.).
Rate of climb at S/L. 150 m./min. (492 ft. min.).
Service ceiling 2,600 m. (8,530 ft.).
Range in still air 500 km. (310 miles).



The LK-1 Four-seat Cabin Monoplane (160 h.p. Walter Minor JW-6-III engine)

GUIDED MISSILES AND MISSILE TEST VEHICLES

SYMBOLS USED IN TABLES

The U.S. Services designate their missiles according to rôle.

Designations in current use by the U.S.A.F. are :—

GAM	Guided air missile (air-to-surface).
GAR	Guided air rocket (air-to-air).
IM	Interceptor missile (surface-to-air).
SM	Strategic missile (surface-to-surface).
TM	Tactical missile (surface-to-surface).

U.S. Navy and U.S. Army missiles are designated in a common system comprising a three-letter group followed by N (Navy) or A (Army) and a sequence number (*e.g.* ASM-N-7, the seventh Navy air-to-surface missile). The prefix X is used to denote an experimental missile. The following U.S. Army and Navy designations are currently in use :—

AAM	Air-to-air.	SSM	Surface-to-surface.
ASM	Air-to-surface.	SUM	Surface-to-underwater.
AUM	Air-to-underwater.	UAM	Underwater-to-air.
SAM	Surface-to-air.	USM	Underwater-to-surface.

In addition, the following unofficial abbreviations have been used for convenience in the "Rôle," "Power-Plant" and "Boosters" columns of the tabular information which appears on the following pages :—

A.-A.	Air-to-air.	S.-A.	Surface-to-air.
A.-S.	Air-to-surface.	S.P.	Solid-propellent.
A.-U.	Air-to-underwater.	S.-S.	Surface-to-surface.
L.P.	Liquid-propellent.	T.V.	Test vehicle.
		U.-S.	Underwater-to-surface.

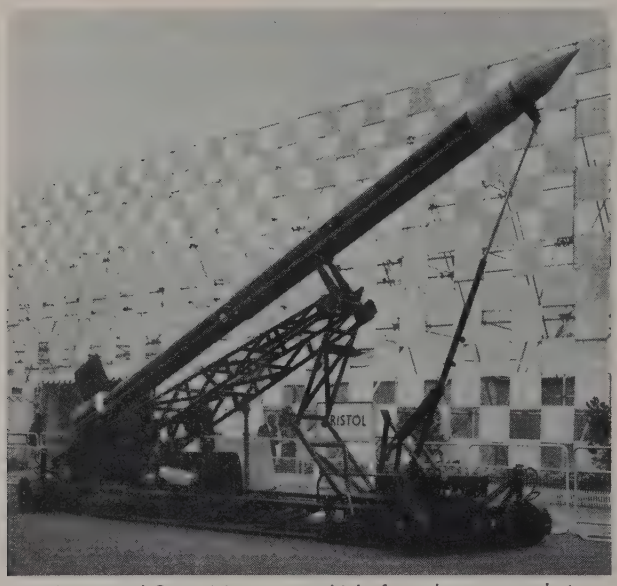
Maker	Type	Rôle	Power Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
GREAT BRITAIN									
Armstrong Whitworth	Seaslug	S.-A.	L.P. (nitric acid/ methanol)	4 triple S.P. (wrapped)	Approx. 20 ft. (6.10 m.)	—	—	—	Medium-range missile, fired from triple launcher with automatic loading. Will arm four new G.W. destroyers of Royal Navy. Beam-rider with semi-active radar homing. General Electric Co. guidance system.
Avro	—	A.-S.	—	—	—	—	—	—	Powered "stand-off" bomb to arm R.A.F. medium bombers. Referred to in Spring of 1957.
Bristol	Bloodhound	S.-A.	2 Bristol Thor ramjets	4 S.P. (wrapped)	22 ft. 2 in. (6.76 m.)	—	—	—	In production for R.A.F. service in 1958. Ferranti guidance. Semi-active homing. Span 9 ft. 3 in. (2.82 m.).
,,	Bobbin	T.V.	Two 16 in. (405 mm.) Thor ramjets	S.P.	—	—	—	—	Missile-type test vehicle with ramjet engines on each side of tail. Ramp launched at 45°. Parachute recovery.
,,	Borzoi	T.V.	I.C.I. S.P. 45,100 lb. (20,455 kg.) s.t. for 5.1 sec.	None	Approx. 20 ft. (6.10 m.)	—	—	—	First seen at 1957 S.B.A.C. Display. Test vehicle for booster rocket.
de Havilland Propellers	Firestreak	A.-A.	S.P.	None	10 ft. 6 in. (3.20 m.)	—	—	—	Intended as standard equipment on P.1B, Javelin, Sea Vixen, etc. Infra-red homing. In production.
,,	—	S.-S.	Reported to be by Rolls-Royce	—	—	—	—	—	Intermediate range ballistic missile. First referred to in Autumn of 1957. Under development.
English Electric	Thunderbird	S.-A.	Napier S.P. (also L.P. version)	4 S.P. (wrapped)	Approx. 20 ft. (6.10 m.)	—	—	—	Marconi guidance system. Semi-active homing. In production for Army and R.A.F.
Fairey	Fireflash	A.-A.	None	2 S.P. each 1,100 lb. (500 kg.) s.t.	9 ft. 7 in. (2.91 m.)	300 lb. (135 kg.)	Approx. Mach 2.0	—	Beam-rider with proximity head, ordered for missile training by R.A.F. First British missile to destroy target aircraft.



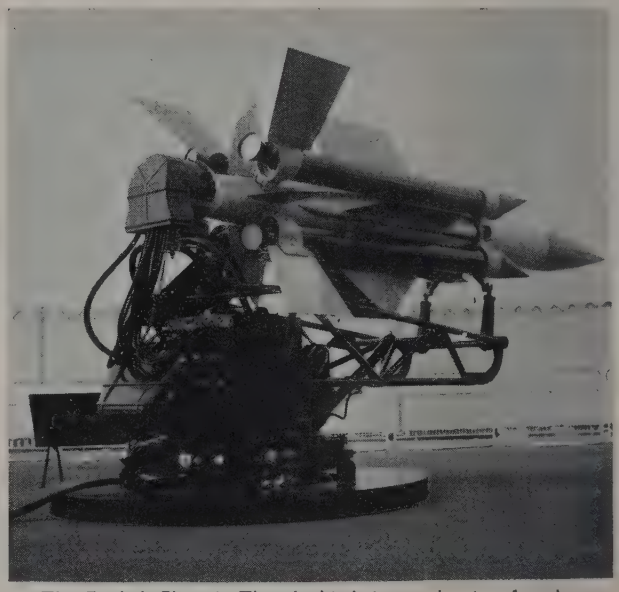


First ground-to-air missile scheduled for service with the R.A.F. in 1958 is the Bristol/Ferranti Bloodhound, powered by two Thor ramjet engines.

The Bristol Bobbin recoverable ramjet test vehicle (*left*) played a major part in the development of the Thor ramjet engine and the Bloodhound missile.



The Bristol Borzoi is a test vehicle for a booster rocket motor designed to give 45,100 lb. s.t. for 5.1 seconds.



The English Electric Thunderbird, in production for the British Army and R.A.F., on its automatically-aimed ramp.

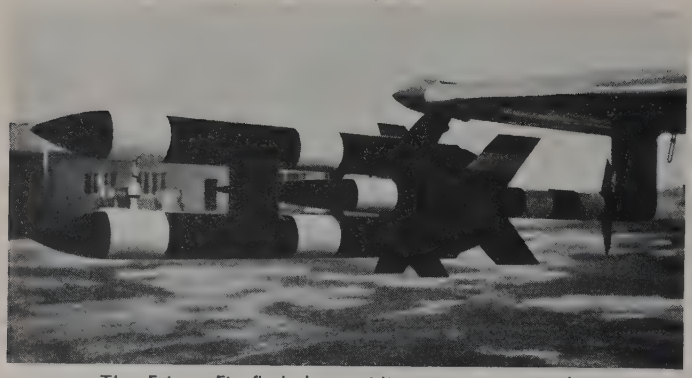


The Short multi-purpose surface-to-air test vehicle.



The de Havilland Firestreak infra-red homing air-to-air weapon on a Sea Vixen interceptor.

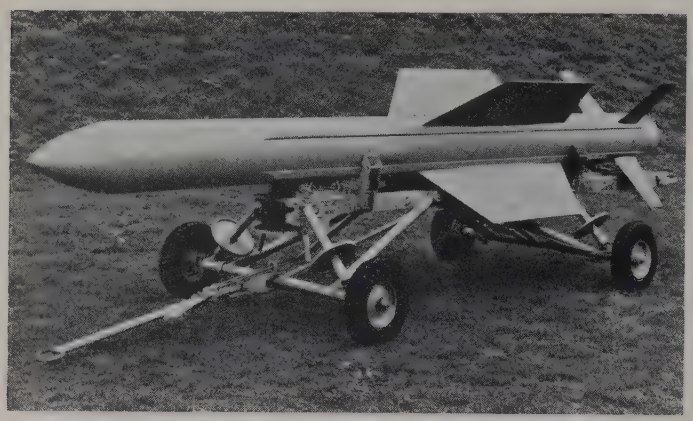
Maker	Type	Rôle	Power Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
GREAT BRITAIN —*cont.*									
Napier	RJTV-21 Series	T.V.	16 in. (405 mm.) Napier ramjet	8 S.P. (wrapped)	Approx. 20 ft. (6.10 m.)	—	—	—	Series of test vehicles for ramjets. Ramp-launched at up to 60°.
Royal Aircraft Establishment	RTV-1	T.V.	L.P. (liquid oxygen/ alcohol) 1,000 lb. (455 kg.) s.t. for 25 sec.	1 S.P. (in-line)	Approx. 17 ft. (5.18 m.) without booster	600-800 lb. (270-360 kg.)	Approx. 2,000 m.p.h. (3,200 km.h.)	—	Radio-guided test vehicle for missile systems. Built in several versions, some by Fairey in Australia.
,,	RTV-2	T.V.	L.P.	4 S.P. (wrapped)	30 ft. (9.14 m.)	—	—	—	Radio-guided test vehicle to investigate stability and control at supersonic speeds. Built by Folland Aircraft.
,,	Skylark	T.V.	Bristol Raven S.P. 11,500 lb. (5,220 kg.) s.t. for 30 sec.	None	25 ft. (7.62 m.)	2,560 lb. (1,160 kg.)	Mach 5.0	—	Meteorological sounding rocket for I.G.Y. research. Ramp-launched. Designed to carry 65 lb. (30 kg.) instruments to height of 100 miles (160 km.). Later version, with booster, to reach 133 miles (214 km.).
Short	General-Purpose Test Vehicle (G.P.T.V.)	T.V.	L.P. (H.T.P./ kerosene) or S.P.	8 S.P. (wrapped)	26 ft. 8½ in. (8.14 m.)	—	—	—	Development of RTV-2 to flight test missile control and propulsion systems. Many hundreds built.
,,	Multi-purpose Test Vehicle	T.V.	S.P.	—	—	—	—	—	First seen at 1957 S.B.A.C. Display.
Vickers-Armstrongs	Type 888 Red Dean	A.-A.	—	None	Approx. 14 ft. (4.25 m.)	Approx. 500 lb. (225 kg.)	—	—	Intended to arm now-abandoned "thin-wing" Javelin interceptor.
,,	Type 891	S.-S.	I.C.I. S.P.	None	3 ft. 1 in. (940 mm.)	under 40 lb. (18 kg.) with container	—	—	Anti-tank missile, in production for British Army. Container forms launching ramp. Radio-controlled with binocular-sight.
FRANCE									
D.E.F.A. (Direction des Etudes et Fabrications d'Armement)	ENTAC	S.-S. A.-S.	S.P.	None	—	26.5 lb. (12 kg.)	180 m.p.h. (290 km.h.)	1.24 miles (2.0 km.)	Wire-guided anti-tank missile to same S.S.10 requirement as Nord 5203. Ordered for evaluation.
,,	PARCA	S.-A.	L.P.	4 S.P. (wrapped)	16 ft. 8 in. (5.08 m.)	2,205 lb. (1,000 kg.)	Mach 1.7	20-24 miles (32-39 km.)	Beam-rider with proximity head. Ramp-launched. Ceiling 82,000 ft. (25,000 m.). Being superseded by later weapons.
Société Matra	MATRA-04	T.V.	S.E.P.R.251 L.P. 2,755 lb. (1,250 kg.) s.t. for 14 sec.	None in air-to-air rôle	15 ft. 1½ in. (4.60 m.)	210 lb. (95 kg.)	Mach 1.5	—	Two-thirds scale test vehicle for future air-to-air and possible surface-to-air anti-aircraft missile.
,,	MATRA-M.20	A.-A.	S.E.P.R.251 L.P. 2,755 lb. (1,250 kg.) s.t. for 14 sec.	None	Approx. 15 ft. (4.55 m.)	—	Mach 1.5	Approx. 1 mile (1.6 km.)	In production to arm the Mystère.
,,	MATRA-051	A.-A.	S.P.	S.P. (in-line)	9 ft. 10½ in. (3.0 m.)	353 lb. (160 kg.)	Mach 1.5	—	Two-stage missile designed for alternative beam-riding or homing. Ordered into production to arm Vautour after successful tests against pilotless target aircraft.
,,	MATRA-510	A.-A.	S.P.	S.P. (in-line)	9 ft. 10½ in. (3.0 m.)	353 lb. (160 kg.)	Mach 1.7	—	Equips Trident, Durandal, etc. Matra autopilot. Drivomatic optical command guidance.
Nord	Nord S.T.450	T.V.	Ramjet	2 S.P.	—	—	Mach 3.0	—	Ramp-launched test vehicle. Ceiling 66,000 ft. (20,000 m.).
,,	Nord 5103	A.-A.	S.P.	S.P. (in-line)	8 ft. 2½ in. (2.50 m.)	297 lb. (135 kg.)	Mach 1.7	4-6 miles (6.4-9.6 km.)	Two-stage beam-riding missile with proximity fuse. Ordered into production after successful tests against pilotless target aircraft. Over 640 built.



The Fairey Fireflash beam-riding air-to-air missile.



The Vickers Type 891 solid-propellent anti-tank missile.



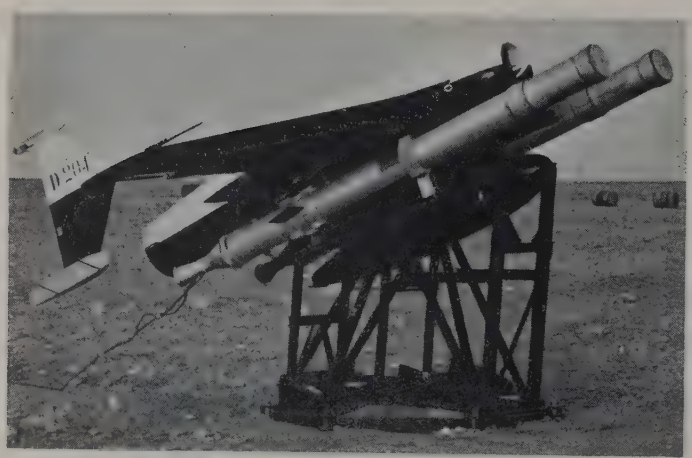
The Vickers Type 888 air-to-air missile which was intended to arm the now-abandoned "thin-wing" Javelin fighter.



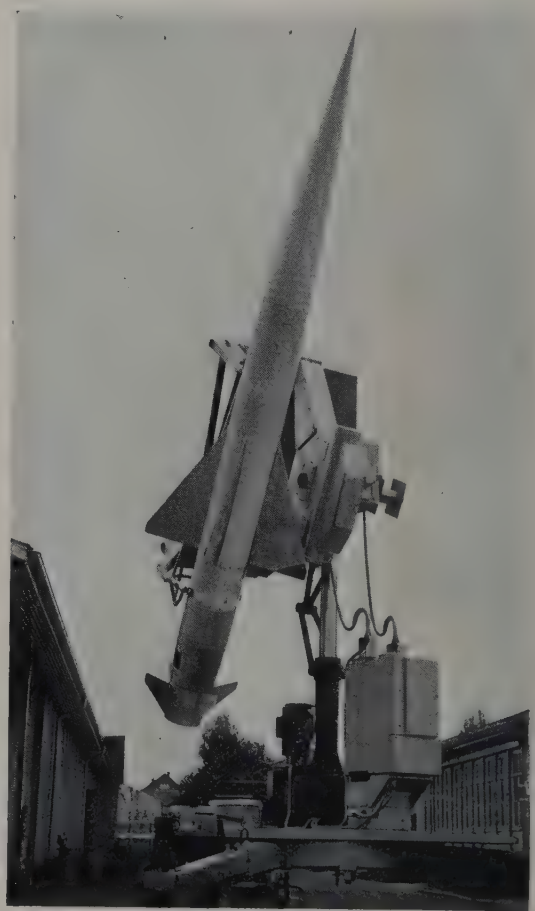
A French PARCA beam-riding missile leaving its launcher.



Nord S.S.10 wire-guided anti-tank missiles have been launched successfully from a Djinn helicopter.

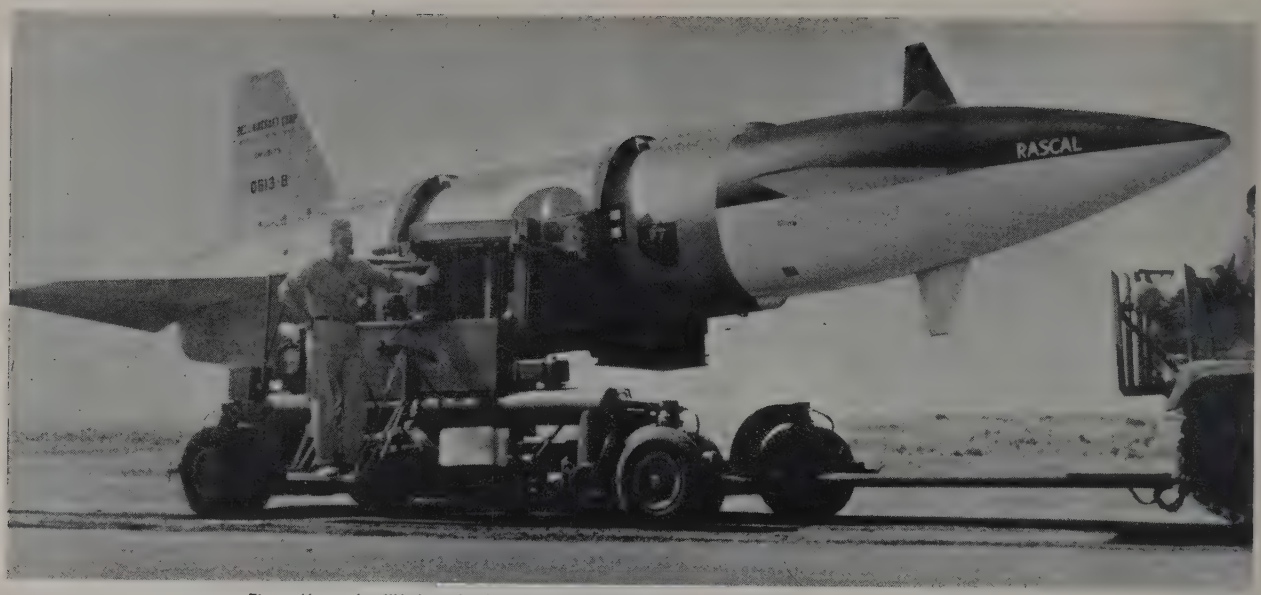


The ramjet-powered SE-4200 bombardment missile on its launching ramp.



An Oerlikon Type 54 surface-to-air beam-riding missile (*right*) on its launcher.

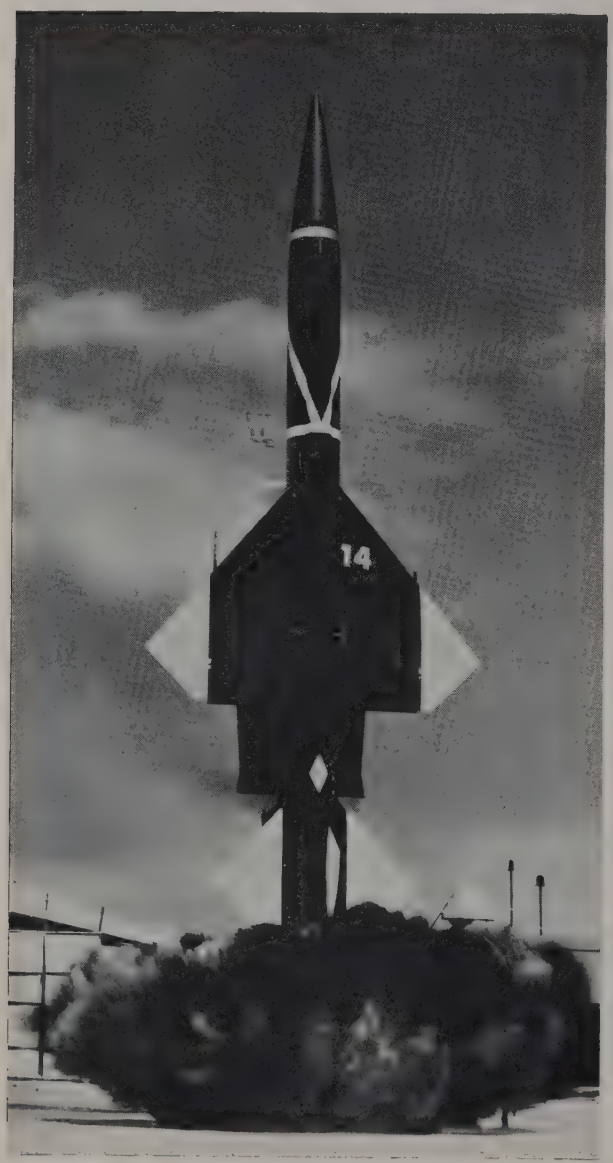
Maker	Type	Rôle	Power Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
FRANCE—*cont.*									
Nord	Nord 5203 (S.S10)	S.-S. A.-S.	S.P.	None	2 ft. 10 in. (0.86 m.)	33 lb. (15 kg.)	175 m.p.h. (285 km.h.)	1 mile (1.6 km.)	Hollow-charge anti-tank missile. Wire-guided and claimed to give 80% hits. In service with French Army and Air Force. Tested from Potez 75 and M.S.502 aircraft and Djinn, Alouette and Bell 47 helicopters. Container forms ground launcher when unfolded.
,,	Nord 5210 (S.S.11)	S.-S. A.-S.	S.P.	S.P. (in-line)	Approx. 4 ft. (1.22 m.)	66 lb. (30 kg.)	450 m.p.h. (720 km.h.)	2.5 miles (4 km.)	Two-stage swept-wing anti-tank missile for longer ranges than Nord 5203. Ordered for service with the French Air Force and Army after successful air-to-surface firing tests. Designed to S.S.11 requirements.
O.N.E.R.A.	—	T.V.	S.P.R.A.20 first stage O.P.d.3202 second stage O.P.d.2012 third stage All S.P.	—	—	—	—	—	Three-stage ramp-launched research rocket.
Sud-Aviation	SE-4100	S.-A.	L.P.	S.P. (in-line)	—	287 lb. (130 kg.)	Mach 0.8		Experimental two-stage anti-aircraft missile. Ceiling 40,000 ft. (12,000 m.).
,,	SE-4200	S.-S.	Ramjet	2 S.P.	Approx. 10 ft. (3.05 m.)	660 lb. (300 kg.)	Mach 0.9	60 miles (100 km.)	Radio-guided ramp-launched missile claimed to offer great accuracy and destructive power over short ranges. Warhead suspended under fuselage. Span 7 ft. 1 in. (2.16 m.).
,,	SE-4300	S.-A.	L.P.	S.E.P.R. 50531	Approx. 18 ft. (5.50 m.)	2,205 lb. (1,000 kg.)	Mach 0.9	—	Interim anti-aircraft missile, for training only. Four swept wings, spanning 7 ft. 1 in. (2.16 m.).
ITALY									
Contin-O.T.E.	M.R.27	S.-A.	—	—	—	—	Mach 1.5	Approx. 30 miles (48 km.)	Under development. O.T.E. electronic equipment.
Polverifici S.A.	Airone	A.-A.	—	—	4 ft. 7 in. (1.39 m.)	22 lb. (10 kg.)	—	7 miles (11.3 km.)	Electric proximity fuse actuated within radius of 160 ft. (50 m.) of target. 500 ordered by Japan.
JAPAN									
—	Kappa-4	T.V.	—	Type 220 (in-line)	26 ft. 7 in. (8.1 m.)	463 lb. (210 kg.)	—	—	Two-stage research rocket for I.G.Y. research. Designed ceiling 37 miles (60 km.).
Mitsubishi	MM-1	A.-A.	Fuji S.P.	—	4 ft. 11 in. (1.50 m.)	44 lb. (20 kg.)	—	—	Under development. Wire-guided. Mitsubishi Electric Co. guidance.
SWITZERLAND									
Contraves/ Oerlikon	Cobra 4	S.-S.	S.P.	None	—	Approx. 24 lb. (10.89 kg.)	—	1 mile (1.6 km.)	Wire-guided anti-tank missile.
Oerlikon	Type 54	S.-A.	L.P. (fuming nitric acid/diesel oil) 2,205 lb. (1,000 kg.) s.t. for 30 sec.	None	19 ft. 8 in. (6.0 m.)	825 lb. (374 kg.)	Mach 1.8	15 miles (24 km.)	Beam-rider with proximity fuse. Guidance effective to height of 49,000 ft. (14,950 m.). Present rockets equipped with parachutes for recovery after training. Developed versions are Types 56 and 57.
U.S.A.									
Aerojet-General	Aerobee (RTV-A-1A)	Research	Aerojet L.P. (nitric acid/ aniline) 2,600 lb. (1,180 kg.) s.t. for 45 sec.	Aerojet S.P. (in-line) 18,000 lb. (8,165 kg.) s.t. for 2.5 sec.	18 ft. 9½ in. (5.72 m.) without booster	1,140 lb. (517 kg.)	2,800 m.p.h. (4,505 km.h.)	—	High-altitude research rocket with structure by Douglas. Launched from 140 ft. (43 m.) tower, has reached heights up to 123 miles (198 km.). Payload of 150 lb. (68 kg.) has included instruments, monkeys, mice.



First "stand-off" bomb developed for the U.S.A.F. is the Bell GAM-63 Rascal.



The ramjet-powered Bendix Talos surface-to-air missile.



The Boeing IM-99 Bomarc anti-aircraft missile is designed for an ultimate range of over 2,500 miles.



The U.S. Army's first trio of big missiles. From left to right : the Honest John artillery rocket, Nike Ajax anti-aircraft missile and Corporal long-range artillery rocket.

Maker	Type	Rôle	Power-Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
U.S.A.—*cont.*									
Aerojet-General	Aerobee-Hi (AJ11-6 and -18)	Research	Aerojet L.P.	Aerojet S.P. (in-line)	23 ft. (7.0 m.)	1,310 lb. (595 kg.)	4,290 m.p.h. (6,900 km.h.)	—	Development of Aerobee. Reached height of 163 miles (262 km.) in mid-1956.
Aerophysics Development (Curtiss-Wright)	Dart (SSM-A-23)	S.-S.	Grand Central Aircraft S.P.	None	6 ft. (1.83 m.)	300 lb. (136 kg.)	Mach 0.7	3 miles (4.8 km.)	Wire-guided anti-tank missile. In production for U.S. Army.
,,	Hypersonic Test Vehicle	T.V.	—	—	—	—	Mach 10.4	—	Four-stage. Has reached height of over 200 miles (320 km.).
Bell	Rascal (GAM-63)	A.-S.	Bell three-chamber L.P. 6,000 lb. (2,720 kg.)	None	35 ft. (10.67 m.)	13,000 lb. (5,900 kg.)	Mach 1.5	100 miles (160 km.)	Air-launched nuclear missile with Federal Telecommunications Laboratory inertial and star-tracking guidance system. Under development for U.S.A.F. First launched in 1953 from B-47.
,,	Shrike	S.-A.	L.P.	—	—	—	—	—	May be anti-missile project. For U.S.A.F.
Bendix	Loki	S.-A.	Grand Central Aircraft S.P.	None	6 ft. (1.83 m.)	—	—	—	Spin-stabilised barrage type anti-aircraft unguided rocket, based on German Taifun. In production.
,,	Talos (SAM-N-6)	S.-A.	McDonnell ramjet	S.P. (in-line)	15 ft. (4.57 m.)	2,500 lb. (1,135 kg.)	Mach 2.5	37 miles (60 km.)	Beam-rider with semi-active homing. H.E. or nuclear warhead. Developed for U.S. Navy by Applied Physics Laboratory, Johns Hopkins University. In production as Talos-L for shore-launching and Talos-W for ship launching. U.S.N. to have eight Talos-armed cruisers by 1962.
Boeing	Bomarc (IM-99)	S.-A.	2 Marquardt RJ43 ramjets 28 in. (710 mm.) diam. and 1 Aerojet L.P.	None	47 ft. (14.33 m.)	15,000 lb. (6,800 kg.)	Mach 2.5	Designed for 250-300 miles (400-480 km.)	Long-range interceptor missile with automatic target radar. H.E. or nuclear warhead. Westinghouse guidance. In production for service with U.S.A.F. in 1959. Span 19 ft. (5.79 m.).
Chance Vought	Dove (AUM-N-4 and 5)	A.-U.	—	—	—	—	—	—	Winged missile for use against ships at sea, developed in conjunction with Eastman Kodak. Infra-red homing. In production for U.S. Navy.
,,	Regulus I (SSM-N-8)	S.-S.	Allison J33-A-14 turbojet 4,600 lb. (2,085 kg.) s.t.	2 Aerojet S.P. each 1,000 lb. (455 kg.) s.t.	33 ft. (10.06 m.)	14,522 lb. (6,587 kg.)	Mach 0.87	250 miles (400 km.)	Command guidance bombardment missile, ramp or trolley-launched from ships, submarines and shore bases. Folding wings. Operational with U.S. Navy on ten carriers, four cruisers, two submarines. Experimental A.-S. version launched from B-52. Test and training version (KDU-1) has retractable landing gear and parachute brake for recovery. Photograph under "Chance Vought" heading in Aircraft section of this book.
,,	Regulus II	S.-S.	Initially Wright J65 turbojet. Later models with General Electric J79 turbojet	—	57 ft. (17.37 m.)	Approx. 35,000 lb. (15,875 kg.)	Over Mach 1.5 at over 50,000 ft. (15,250 m.)	—	Supersonic attack missile for which very large contract was announced in July, 1956. Lock-on active guidance. Test models with retractable landing gear. Span approx. 20 ft. (6.10 m.). Photograph under "Chance Vought" heading in Aircraft section of this book.
Chrysler	Redstone (Jupiter A)	S.-S.	North American L.P. (liquid oxygen/alcohol) 65,000 lb. (29,500 kg.) s.t.	None	69 ft. 6 in. (21.18 m.)	40,000 lb. (18,145 kg.)	Mach 5.0	300 miles (480 km.)	Tactical bombardment missile with optional nuclear warhead, in service with U.S. Army. Air transportable. Design and pre-production at Redstone Arsenal, by team of U.S./German technicians under Dr. von Braun, designer of German V.2 rocket. Inertial guidance.



The Chrysler Redstone tactical bombardment missile.

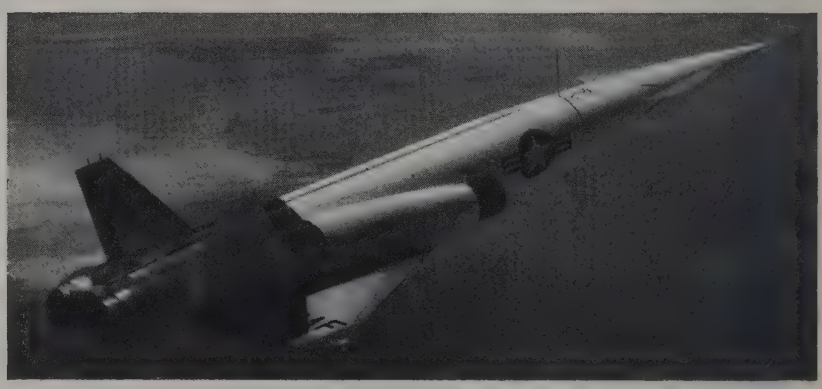


A Lockheed P2V Neptune carrying two Fairchild Petrel anti-submarine or air-to-underwater guided missiles, built around standard torpedoes.

Right: Two Convair Terrier surface-to-air missiles on their shipboard launcher.

Below: The North American X-10, built to flight-test components for air-breathing long-range bombardment missiles.





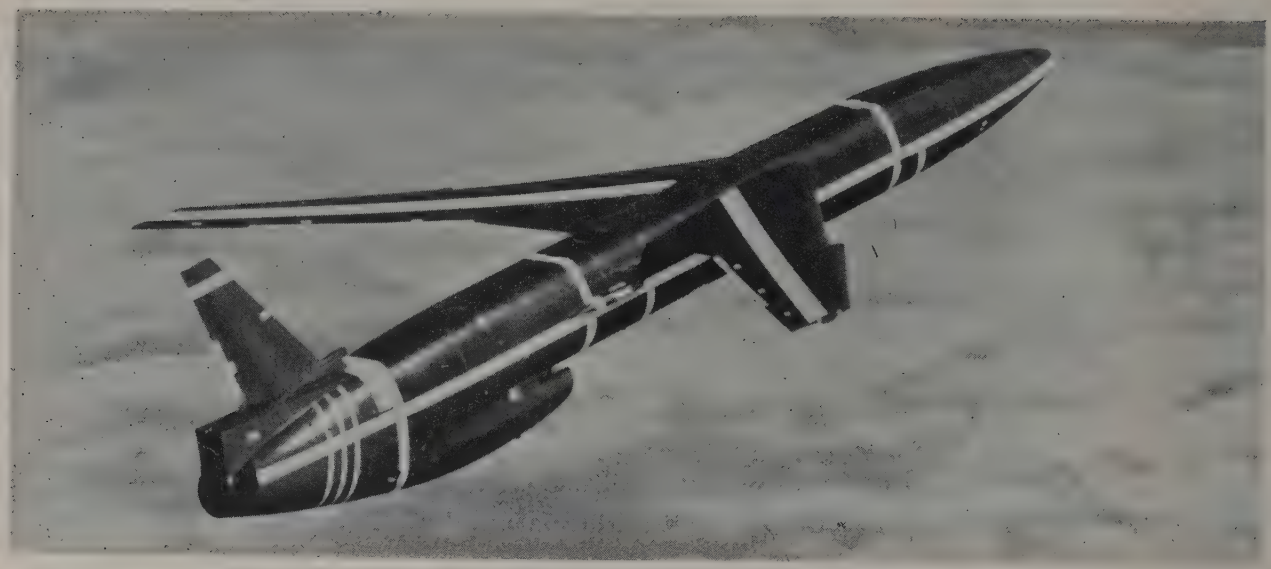


The Hughes GAR-2A Falcon air-to-air infra-red homing weapon.



Now re-designated TM-76A, this version of the Martin Matador tactical bombardment missile has Atran guidance.

Maker	Type	Rôle	Power Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
U.S.A.—*cont.* Chrysler and Army Ballistic Missile Agency	Jupiter C	S.-S.	North American S-3 L.P. 154,000 lb. (70,000 kg.) s.t.	None	—	—	Mach 15.0	1,500 miles (2,400 km.)	I. R. B. M. (Intermediate range ballistic missile) developed from Redstone for U.S. Army and Navy. Inertial guidance by Ford Instrument Company. Reached designed range on third test firing in mid-1957.
Convair	Atlas (SM-65, WS-107A)	S.-S.	North American L.P. 135,000 lb. (61,250 kg.) s.t. for 8-12 min.	2 North American L.P. each 100,000 lb. (45,360 kg.) s.t. for 3 min.	Approx. 80 ft. (24.4 m.)	Approx. 90,000 lb. (40,800 kg.)	Mach 15.0	5,000 miles (8,045 km.)	I.C.B.M. (Intercontinental ballistic missile) with thermonuclear warhead. General Electric inertial guidance and nose-cone. Under development for U.S.A.F. First test firing June 11, 1957, resulted in disintegration after take-off.
,,	Tartar	S.-A.	Allegheny Ballistic Laboratory S.P.	None	12 ft. (3.66 m.)	—	—	—	Active homing. In production for U.S. Navy, which will have 17 Tartar-armed ships by 1962.
,,	Terrier (SAM-N-7)	S.-A.	Kellogg S.P.	Aerojet S.P. (in-line)	27 ft. (8.23 m.)	3,360 lb. (1,524 kg.)	Mach 2.5	20 miles (32 km.)	Developed by Applied Physics Laboratory, Johns Hopkins University. Beam-rider with Philco proximity fuse. In operational service aboard cruisers and frigates of U.S. Navy. Terrier II similar but with homing head. U.S.N. to have 22 Terrier-armed ships by 1962.
,,	—	S.-A.	—	—	—	—	—	—	Anti-missile project.
Cook Research Laboratory	Cherokee	A.-A.	—	—	—	500 lb. (227 kg.)	Mach 3.0	—	Under development for U.S.A.F. 26 lb. (12 kg.) warhead.
,,	Skokie I and II	A.-A.	—	—	—	—	—	—	Under development for U.S.A.F.
Douglas	Bird Dog	—	—	—	—	—	—	—	Under development.
,,	Genie MB-1	A.-A.	North American L.P.	—	—	—	—	—	Originally known as Ding-Dong. Hughes guidance system and atomic warhead. In service with U.S.A.F. to arm F-89, F-101, F-106, etc.
,,	Honest John	S.-S.	Hercules S.P.	None	28 ft. 2 in. (8.58 m.)	12,000 lb. (5,445 kg.)	Mach 1.5	20 miles (32 km.)	762 mm. spin-stabilised unguided artillery rocket fired from mobile ramp, with H.E. or atomic warhead. In service with U.S. and Danish Armies.
,,	Little John XM-47	S.-S.	Hercules S.P.	None	12 ft. (3.66 m.)	980 lb. (445 kg.)	—	10 miles (16 km.)	Smaller version of Honest John for U.S. Army. 318 mm. Spin-stabilised.
,,	Nike-Ajax (SAM-A-7)	S.-A.	Aerojet L.P. (nitric acid/ petrol)	Hercules S.P. (in-line)	35 ft. (10.67 m.)	2,600 lb. (1,180 kg.)	Mach 2.1	20 miles (32 km.)	Standard U.S. Army anti-aircraft missile, defending 13 U.S. cities and serving also in Europe. Bell command guidance with semi-active radar homing.
,,	Nike-Hercules	S.-A.	S.P.	S.P.	41 ft. 6 in. (12.65 m.)	Approx. 10,000 lb. (4,535 kg.)	Approx. Mach 2.5	40 miles (64 km.)	Longer range than Nike-Ajax, with ability to carry nuclear warhead. Initial beam-riding, with semi-active radar homing. In service with U.S. Army. Ordered by Denmark.
,,	Nike-Zeus	S.-A.	—	—	—	—	—	—	No details available.
Douglas/Sperry and Canadair (Canada)	Sparrow I (AAM-N-2)	A.-A.	Aerojet S.P.	None	12 ft. (3.66 m.)	295 lb. (134 kg.)	Mach 2.7	5 miles (8 km.)	Beam-rider with radar homing. Operational with U.S. Navy in various forms including AAM-N-3 (Sparrow II) and -6 (Sparrow III), the latter with active homing. Photograph of Sparrow mounted on McDonnell Demon in Aircraft section of this book.
Douglas	Thor (WS-135A)	S.-S.	North American S-3 L.P. 154,000 lb. (70,000 kg.) s.t.	None	—	—	—	Approx. 1,500 miles (2,400 km.)	I.R.B.M. (Intermediate range ballistic missile) under development for U.S.A.F. A.C. Spark Plug inertial guidance. General Electric nose-cone. Ordered into production after successful firings.





The Northrop SM-62 Snark (*above*) is entering service as the first American intercontinental missile.

The Curtiss-Wright Dart (*left*) wire-guided anti-tank missile, fired usually from a ramp on a standard army truck.

Now in service, the Nike Hercules (*right*) is a much-improved development of the original Nike Ajax anti-aircraft missile.

The three-stage Lockheed X-17 (*below left*) is testing components of America's I.C.B.M.'s, and particularly the "bluff-nose" warheads.

The Martin Lacrosse (*below right*) all-weather field artillery missile on its launching truck.







Maker	Type	Rôle	Power Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
U.S.A.—*cont.*									
Fairchild	Duck	A.-S.	—	—	—	—	—	—	Part of B-58 weapons system. Guidance by A.C. Spark Plug Division, General Motors Corp.
,,	Goose (AUM-N)	A.-U.	Fairchild J83 or General Electric J85 turbojet	—	-	-	—	—	Long-range missile, under development for U.S.A.F. for anti-submarine operations.
,,	Petrel (AUM-N-2)	A.-U.	Fairchild J44 turbojet 1,000 lb. (455 kg.) s.t.	None	24 ft. (7.3 m.)	3,800 lb. (1,720 kg.)	Mach 0.7	—	Air-launched anti-submarine missile based on standard torpedo. Radio-guided in flight, self-homing underwater. In service with U.S. Navy. Span 13 ft. (3.96 m.).
Firestone	Corporal E (SSM-A-17)	S.-S.	Jet Propulsion Lab., Cal. Tech. L.P. approx. 20,000 lb. (9,070 kg.) s.t.	None	45 ft. (13.72 m.)	12,000 lb. (5,445 kg.)	Mach 3.5	50 miles (80 km.)	Artillery rocket with airframe by Firestone, motor built by Ryan and command guidance by Gilfillan Brothers. H.E. or nuclear warhead. Delivered to U.S. Army. Corporal F is improved version for U.S. and British Armies, with 100 mile (160 km.) range.
Hughes/Philco	Falcon (GAR-1D)	A.-A.	Thiokol S.P. 6,000 lb. (2,720 kg.) s.t. for 1½ sec.	None	6 ft. 6 in. (1.98 m.)	122 lb. (55 kg.)	Mach 2.8	4 miles (6.4 km.)	Beam-riding missile with semi-active radar homing, in operational service with U.S.A.F. Hughes guidance system. GAR-2A is new version with infra-red homing.
Lockheed	Polaris	U.-S. S.-S.	Aerojet S.P.	—	50 ft. (15.25 m.)	—	—	1,500 miles (2,400 km.)	Naval Fleet Ballistic Missile (I.R.B.M.). General Electric inertial guidance. Can be launched from submerged or surfaced submarines. Under development.
,,	X-7	T.V.	Ramjet	None	—	—	—	—	Ramjet test vehicle with configuration on lines of F-104 interceptor. Ramjet slung under rear fuselage. Recoverable by parachute.
,,	X-17	T.V.	S.P.	2 S.P. (in-line)	40 ft. (12.20 m.)	12,000 lb. (5,445 kg.)	—	—	Three-stage test vehicle for I.C.B.M. components; primarily for warhead re-entry research. Many fired. Ceiling over 300 miles (480 km.).
Martin	Bullpup (ASM-N-7)	A.-S.	Aerojet S.P.	—	11 ft. (3.35 m.)	600 lb. (272 kg.)	—	—	"Stand-off" bomb. Tail-first configuration. Under development for U.S. Navy and Marines.
,,	Lacrosse	S.-S.	Thiokol S.P.	None	20 ft. (6.10 m.)	3,300 lb. (1,500 kg.)	Mach 0.8	10-12 miles (16-19 km.)	All-weather radio-guided winged close-support missile in service with U.S. Army and Marines. Developed by Cornell Aeronautical Lab. Production by Martin.
,,	Matador (TM-61A)	S.-S.	Allison J33-A-37 turbojet 4,800 lb. (2,175 kg.) s.t.	Aerojet S.P. 4,000 lb. (1,815 kg.) s.t. for 2 sec.	39 ft. 6 in. (12.04 m.)	12,000 lb. (5,445 kg.)	Mach 0.9	620 miles (1,000 km.) at 35,000 ft. (10,670 m.)	Command guidance bombardment missile using radar intelligence. In U.S.A.F. service in U.S. and Europe. Ramp-launched from mobile trailer. Span 28 ft. 7 in. (8.70 m.).
,,	Matador (TM-76A)	S.-S.	Allison J33-A-39 turbojet	Aerojet S.P.	42 ft. 1 in. (12.83 m.)	15,000 lb. (6,800 kg.)	Mach 0.9	800 miles (515 km.)	Formerly TM-61B. Longer, more rounded nose than TM-61A. New Atran inertial guidance system. Announced March, 1956. Improved TM-76B (formerly TM-61C) has Shanicle guidance and pointed nose.
,,	Titan (WS-107A)	S.-S.	Aerojet L.P. 60,000 lb. (27,200 kg.)	Aerojet L.P. 300,000 lb. (136,000 kg.)	—	—	Mach 15.0	5,000 miles (8,045 km.)	I.C.B.M. (Intercontinental ballistic missile), in production for U.S.A.F. Bosch-Arma inertial guidance. Avco nose-cone.

Maker	Type	Rôle	Power Plant	Boosters	Length	Launching Weight	Speed	Range	Remarks
U.S.A.—*cont.*									
Martin	Vanguard	T.V.	First Stage General Electric L.P. 27,000 lb. (12,250 kg.) s.t. Second Stage Aerojet L.P. Third Stage S.P.	--	72 ft. (21.95 m.)	Slightly over 22,000 lb. (9,980 kg.)	Mach 27.3	—	Research rocket, intended to put small earth satellite vehicle into orbit around earth as part of U.S. I.G.Y. programme. Designed orbital height 300 miles (480 km.). First stage is developed from Viking research rocket. Second stage developed by Aerojet General.
,,	Viking	Research	Reaction Motors L.P. (liquid oxygen/alcohol) 20,500 lb. (9,300 kg.) s.t.	None	42 ft. (12.80 m.)	(Viking 11) 14,940 lb. (6,775 kg.)	3,400 m.p.h. (5,470 km.h.)		Series of high altitude research rockets with payload of 500-2,500 lb. (225-1,135 kg.) depending on height required. Viking No. 11 holds single-stage altitude record of 158 miles (254 km.).
McDonnell	Quail (GAM-72)	A.-S.	—	—	—	—	—	—	Countermeasures missile ordered in 1957.
,,	Triton SSM-N-2	S.-S.	2 McDonnell ramjets	S.P.	45 ft. (13.72 m.)	20,000 lb. (9,070 kg.)	Mach 3.5 at over 80,000 ft. (24,400 m.)	over 1,500 miles (2,400 km.)	Cruise-type missile, using high-energy fuel, for U.S. Navy. Can be launched from submarines.
North American	Navaho (SM-104, WS-104)	S.-S.	2 Wright RJ47 ramjets 48 in. (1,220 mm.) dia.	North American L.P.	—	100,000 lb. (45,360 kg.)	Mach 3.5	2,500 miles (4,025 km.)	Long-range missile using star-tracking guidance system and infra-red homing. Canard missile side-by-side with jettisonable booster. Cruising height 100,000 ft. (30,500 m.). Project cancelled in 1957.
,,	X-10	T.V.	2 Westinghouse J40 turbojets with reheat	—	—	—	—	—	Test vehicle for Navaho. With 60° nose trimmer. Approx. 25 built 1952-53 and tested since 1954. Landing gear and parachute brake for recovery. Programme completed.
,,	—	A.-S.	—	—	—	—	—	—	Development contract announced in 1957.
Northrop	Snark (SM-62)	S.-S.	Pratt & Whitney J57 turbojet approx. 11,000 lb. (4,990 kg.) s.t.	2 S.P. each 33,000 lb. (14,970 kg.) s.t.	69 ft. (21.03 m.)	Approx. 35,000 lb. (15,875 kg.)	Mach 0.9	4,000 miles (6,400 km.)	Ramp-launched strategic bombardment missile in service with U.S.A.F. Ultimate designed range of 5,000 miles (8,045 km.). Star-tracking guidance system. Large external fuel tanks under wing roots. Nuclear or H.E. warhead. Span 42 ft. (12.80 m.). Test versions have tail parachute and skids for recovery under radio control.
Philco/Martin	Sidewinder (AAM-N-7, GAR-8)	A.A.	Hercules S.P.	None	9 ft. 2½ in. (2.80 m.)	150 lb. (68 kg.)	Mach 2.4	4-6 miles (6.4-9.6 km.)	Infra-red homing. Production by Philco and General Electric to arm U.S. Navy and U.S.A.F. interceptors. Photograph of Sidewinders mounted on Grumman Cougar in Aircraft section of this book.
Raytheon	Hawk I	S.-A.	L.P.	None	16 ft. (4.88 m.)	—	—	45 miles (72 km.)	In service with U.S. Army for anti-aircraft defence at heights down to ground level. Infra-red homing. Mobile triple launcher.
Radioplane	Crossbow (MX-2013)	A.-S.	Turbojet	—	—		—		Electronic counter-measures missile, under development for U.S.A.F.
Republic	Terrapin	T.V.	Thiokol T-55 S.P.	Allegheny Ballistics Lab. Deacon S.P. duration 6 sec.	under 15 ft. (4.57 m.)	224 lb. (101.6 kg.)	Mach 5.8		For University of Maryland high altitude research project. Low-cost two-stage rocket. Ramp-launched at 75°. Ceiling 80 miles (130 km.). Several dozen built. Three-stage version under development.
Sandia	Lulu	A.-U. A.-S.	—	—	—	—	—	—	Anti-shipping and anti-submarine missile under development for U.S. Navy. Nuclear warhead.

ALL THE WORLD'S AERO-ENGINES

(CORRECTED TO SEPTEMBER 30th, 1957)

ARRANGED IN TWO PARTS:

(1) GAS-TURBINE ENGINES
(2) PISTON ENGINES

PART I—GAS-TURBINE ENGINES

BELGIUM

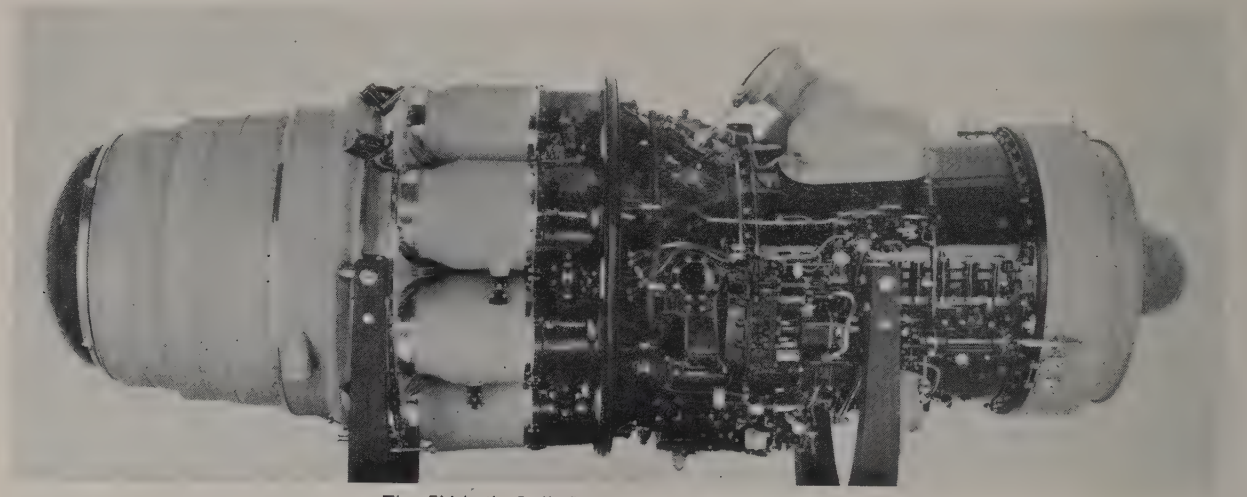
FN

FABRIQUE NATIONALE D'ARMES DE GUERRE, S.A.

HEAD OFFICE AND WORKS : HERSTAL-LEZ-LIÈGE.

This great armaments company undertook the manufacture under licence some years ago of Rolls-Royce Derwent turbojets for the Gloster Meteor fighters which were built in Belgium and the Netherlands. By the time FN ceased production of Derwents in 1955, it had delivered a total of more than 1,000 of those engines.

Meanwhile, it had begun the manufacture of Rolls-Royce Avon 100-series turbojets for the Hawker Hunter fighters which had superseded the Meteor in production in Belgium and the Netherlands. These engines have been followed by Avon 200-series turbojets for the latest version of the Hunter which is currently in production. A full description of the basic 100 and 200 Series Avons appears under "Rolls-Royce" in the British section of this work.



The FN-built Rolls-Royce Avon turbojet engine.

THE BRITISH COMMONWEALTH

GREAT BRITAIN

ARMSTRONG SIDDELEY

ARMSTRONG SIDDELEY MOTORS LTD.

HEAD OFFICE AND WORKS : COVENTRY.

Directors : Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman), Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S., H. Burroughes, F.R.Ae.S., H. T. Chapman, C.B.E., F.R.Ae.S., M.I.Mech.E. (Managing Director), W. F Saxton, M.B.E. (General Manager), W. H. Lindsey, M.A., F.R.Ae.S. (Technical Director), J. E. Attwood.

Prior to their entry into the gas-turbine field Armstrong Siddeley Motors had done some of the early experimental work on axial-flow compressors and blade forms, as well as manufacturing the R.A.E. research contra-flow unit in 1939 to the designs of Dr. Griffiths.

First Armstrong Siddeley gas-turbine to enter production was the Python turboprop which first ran and passed its acceptance test in 1945. The Python engine powers the Westland Wyvern S. Mk. 4 strike aircraft and has been described in earlier editions of "All the World's Aircraft."

In 1945 it was decided to design a turboprop engine in the 1,000 h.p. class, and in April, 1946, the prototype engine, named the Mamba, ran for the first time. The Mamba passed its Type-Test in February, 1948 and has been produced for the Short Seamew aircraft.

The Sapphire turbojet has been in large-scale production for several years for the Hawker Hunter, Gloster Javelin and Handley Page Victor aircraft.

Research and development of the Sapphire are handled by the parent company at Coventry ; but its subsidiary, Armstrong Siddeley (Brockworth) Ltd., in Gloucestershire, is responsible for quantity production. More than 2,000 Sapphires had been built in the U.K. by February, 1957.

Other important engines are the Double Mamba, which powers the Fairey Gannet, and the Viper, which was evolved as a "short-life" engine but has since been developed as a conventional long-life engine and in its latter form powers the Hunting Percival Jet Provost trainer, the Saunders-Roe S-R.53, the Sud-Aviation SO.9000 and SO.9050 Trident, the Macchi M.B.326, the Dassault Mirage I and an Ikarus ground attack aircraft.

Armstrong Siddeley is also developing a series of liquid-fuel rocket motors at its Rocket Division at Ansty, near Coventry. The first of these engines was the Snarler (2,000 lb.=910 kg. s.t.), which was flight tested for the first time on November 20, 1950, in the Hawker P.1072, a modified Sea Hawk prototype. Details of a second Armstrong Siddeley rocket motor, the Screamer, were released in 1956 and are given hereafter. Further types of rocket motor are known to be under development.

In 1950 the Curtiss-Wright Corporation acquired the right to build Armstrong Siddeley gas-turbine engines in the United States and had produced well over 8,000 J65 (Sapphire) turbojets by early 1957.

In 1953 a licence for the manufacture in France of the Viper long-life turbojet engine was acquired by Avions (now Générale Aéronautique) Marcel Dassault.

In May, 1957 it was announced that Armstrong Siddeley had acquired the licence to manufacture in Britain the auxiliary power gas-turbines and air turbine starters developed by the AiResearch Manufacturing Divisions of the Garrett Corporation of Los Angeles, U.S.A.

THE ARMSTRONG SIDDELEY SAPPHIRE SERIES 100.

The Sapphire engine is a turbojet with an axial-flow compressor and an annular combustion chamber of the Armstrong Siddeley vaporising type.

It was designed originally by Metropolitan-Vickers, Ltd., from whom full responsibility for further design, development and production was taken over by Armstrong Siddeley in 1948. As a result of running experience with the early versions, Armstrong Siddeley made a number of major design changes, which resulted in the ASSa.3 version.

Further extensive development led to a new family of Sapphires with important design changes, including a redesigned compressor. Known as the Series 200, these engines are described separately after the description of the Series 100 engine.

The following versions of the Series 100 Sapphire have been announced : —

ASSa.1. Initial Metropolitan-Vickers design. Rated at 7,000 lb. (3,175 kg.) s.t.

ASSa.2. Developed version rated at 7,380 lb. (3,347 kg.) s.t.

ASSa.3. First version incorporating results of Armstrong Siddeley running experience. Completed a 150-hour Service Type Test in November, 1951, at a sea level static maximum rating of 7,500 lb. (3,400 kg.) with a specific consumption of 0.91 lb./hr./lb. (0.91 kg./hr./kg.). Its current rating is 7,590 lb. (3,442 kg.).

ASSa.5. Special version of ASSa.6 for English Electric P.1A. Rated at 8,300 lb. (3,765 kg.) s.t. One version fitted with reheat.

ASSa.6. Development of ASSa. 3 with higher r.p.m. In May, 1952, passed the 150-hour Type Test at 8,300 lb. (3,770 kg.) s.t., as a result of which the engine was cleared for production at 8,200 lb. (3,720 kg.) thrust.

ASSa.12. Mechanically similar to ASSa. 6, but has cast turbine rotor blades which allow an increased turbine-inlet temperature, giving a rated thrust of 8,500 lb. (3,856 kg.).

Re-heat, or afterburning, is being developed for the Sapphire and flight testing continues in specially converted Canberra and Javelin flying test-beds. In addition, reheated Sapphire ASSa.5 turbojets power one of the prototypes of the English Electric P.1.

The Sapphire powers the Gloster Javelin, the Hawker Hunter F. Mk. 2 and 5, the Handley Page Victor, the English Electric P.1A, the third prototype S.O. 4050 Vautour and the Swiss P.1604 fighter.

The Sapphire is in large-scale production in the United States, under the designation J65, by the Wright Aeronautical Corporation.

The following details apply specifically to the Sapphire ASSa.6, but are generally applicable to other Series 100 engines :—

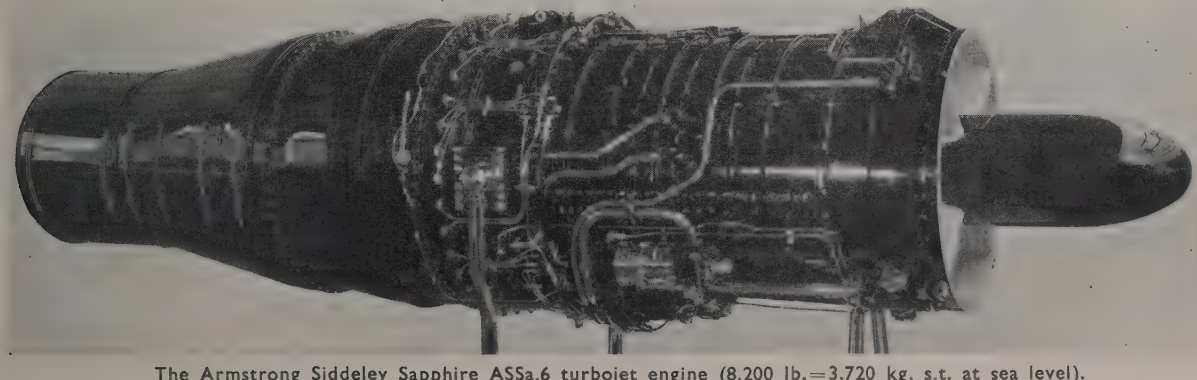
TYPE.—Axial-flow Turbojet.

AIR INTAKE.—Annular type at front of engine.

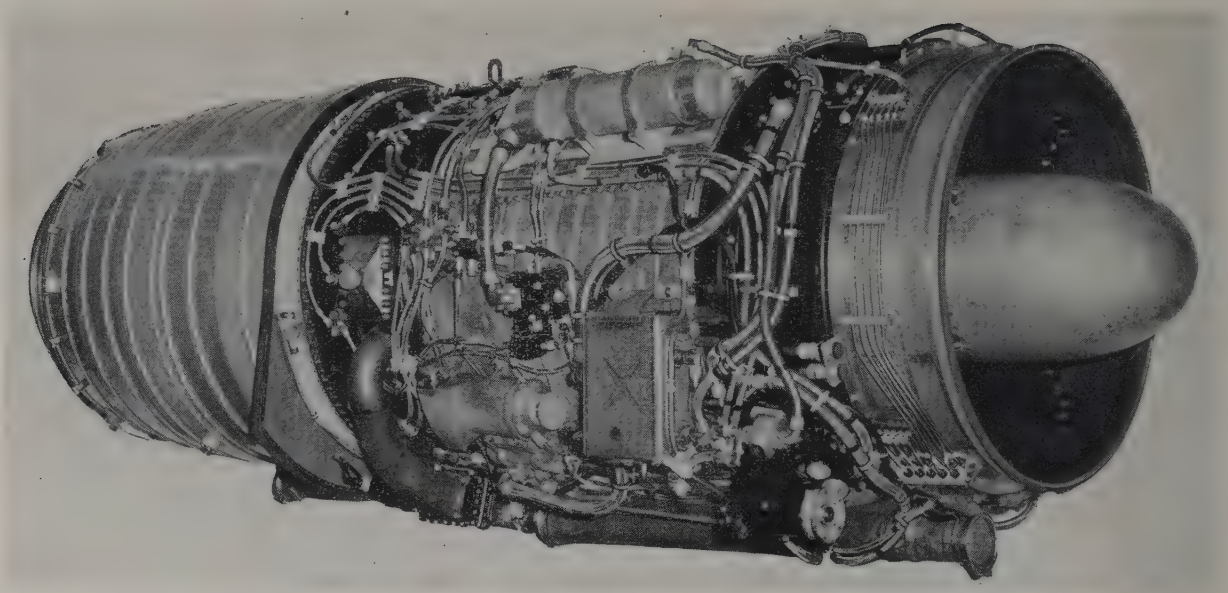
COMPRESSOR.—Thirteen stage axial-flow, first three stages forming low-pressure section and last ten high-pressure section. 1,062 rotor blades secured by "fir-tree" roots in steel discs shrunk and dogged on hollow aluminium-alloy (MAT 101) drum. First three rows of blades are close-forged in S.62 stainless steel. From the fourth to seventh stage the blades are close-forged in aluminium alloy, machined only at root and tip. The last six stages are of stainless steel. One row of inlet guide vanes and all 652 stator blades (first seven rows stainless steel close-formed stampings ; last six in steel rough stampings) secured by dovetail roots in carrier rings which are split for ease of assembly in compressor case. First seven rows of stator blades are shrouded. Compressor shaft carried on ball-bearing (front) and single-row roller-bearing (rear). Compressor casing cast in top and bottom halves in L.51 aluminium alloy, bolted together.

COMBUSTION CHAMBER.—Single annular type with inner and outer flame tubes between which combustion takes place. Outer tube of Fox Fortiweld ; inner tube of DTD493. Thirty-six Armstrong Siddeley type fuel-air vaporisers. Fuel and primary air fed into hook-shape vaporiser tubes whose open ends point upstream. Secondary air enters chamber through 36 air distributing tubes to mix with combustion flame near vaporiser tubes. B.T.H. high energy ignition unit type C.10/TS/2. Two Lodge high energy igniter plugs in diametrically-opposite positions.

FUEL SYSTEM.—Armstrong Siddeley vaporising type. Pressure of 480 lb./sq. in. (33.75 kg./cm.^{2}) at burners supplied by Dowty Type ENG.129 fuel pump. Armstrong



The Armstrong Siddeley Sapphire ASSa.6 turbojet engine (8,200 lb.=3,720 kg. s.t. at sea level).



The Armstrong Siddeley Sapphire ASSa.7 turbojet engine (11,000 lb.=4,990 kg. s.t. at sea level).

Siddeley-Hobson barometric flow control and distributors (six). Lucas air-fuel ratio control.

FUEL GRADE.—DERD.2482 or 2486. As emergency alternative 100 BO AVGAS.

NOZZLE GUIDE VANES.—Aerofoil type, cast in Nimonic 80.

TURBINE.—Two-stage turbine, each disc forged in ferritic steel (Rex 448 or Jessops H.46), coupled together by dowels. Front disc in turn dowelled to turbine stubshaft. First stage has N.90 blades, second stage N.80A blades, all secured by "fir-tree" roots and locked by special split pins. Surrounding the turbine assembly is a series of ring assemblies, carrying the N.80 stator blades. Front end of turbine rotor shaft bolted to compressor rotor shaft drive coupling. Single-row roller bearing forward of rotor disc assembly.

JET PIPE.—Fixed type (either fixed or two-position nozzle when 25% boost afterburner fitted). Steel jet pipe with light alloy outer shrouds, separated by Alfol lagging. Fully floating central bullet.

ACCESSORY DRIVE.—Off front of compressor, via shaft and bevel through air intake spokes. Accessories on "kidney box" below compressor.

LUBRICATION SYSTEM.—Full flood to front bearing. Micro-feed with air blast cooling to centre and rear bearings. Capacity 9½ Imp. pints (5.4 litres). Supplied at pressure of 30 lb./sq. in. (2.11 kg./cm.²) by Tecalemit pump.

OIL SPECIFICATION.—D.Eng. R.D. 2487.

MOUNTING.—Three point trunnion suspension, with one point on top of intake flange and others on each side of centre section.

STARTING.—Rotax type CT.0201-L cartridge turbo-starter bolted to front of intake hub.

DIMENSIONS.—
Diameter, excluding accessories 37.4 in. (950 mm.).
Length overall 134 in. (3,400 mm.).

WEIGHT.—
Dry 2,650 lb. (1,202 kg.).

PERFORMANCE RATING.—
Static thrust 8,200 lb. (3,720 kg.) at sea level.

CONSUMPTION.—
Fuel 0.90 lb./lb. s.t./hr. (0.90 kg./kg. s.t./hr.).
Oil 1½ Imp. pints (0.85 litres) hr.

THE ARMSTRONG SIDDELEY SAPPHIRE SERIES 200.

The Series 200 Sapphire was developed from the Series 100 to provide an engine suitable for very high subsonic and supersonic speeds, with a much greater thrust than the ASSa.6, but with a minimum of installational changes. The following versions have been announced :—

ASSa.4. Basically similar configuration to ASSa.6. First run in July, 1952. Rated at 9,700 lb. (4,400 kg.) s.t.

ASSa.4/7. Modified version of ASSa.4 with change from aluminium to steel compressor casing.

ASSa.7. Further development of ASSa.4 with flared annulus, achieved by change in turbine root and tip diameters. Reverted to aluminium compressor casing. In September, 1954, was type-tested at 10,200 lb. (4,650 kg.) thrust with a specific fuel consumption of 0.885 lb./hr./lb. (0.885 kg/hr./kg.), thus becoming the first British turbojet engine to be type-tested at over 10,000 lb. (4,540 kg.) s.t. Passed further type test at 10,500 lb. (4,765 kg.) s.t. in March, 1955. Following later changes, including introduction of unshrouded turbine rotor blades, production engines have been rated since March, 1956 at 11,000 lb. (4,990 kg.) s.t.

ASSa.8. Development of ASSa.7 with air-cooled turbine blading. Rated at 12,360 lb. (5,606 kg.) s.t. No production.

ASSa.9. Further development of ASSa.7 with zero-stage in compressor and variable-incidence guide vanes. Rated at 12,700 lb. (5,760 kg.) s.t. No production.

The following details apply specifically to the Sapphire ASSa.7 :—

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular type at front of engine. Hot air from compressor exit ducted through intake struts, inlet guide vanes and nose fairing.

COMPRESSOR.—Thirteen-stage axial-flow. Rotor blades machined from stampings in S.62 steel and attached to a series of discs which are curvic coupled to steel shaft. First six rows have serrated root fixings; last seven rows are riveted to discs. Total of 584 stator blades, made in S.62 steel and with dovetail roots fitting into loose rings. Shaft carried in front thrust and rear roller bearing. Casing made from L.51 aluminium alloy to R.R.50 specification with magnesium-zirconium Z.T.1 as alternative.

COMBUSTION CHAMBER.—Similar to series 100 Sapphire, but with more definite form of splitter-diffusion section and only 24 fuel vaporiser tubes.

FUEL SYSTEM.—Armstrong Siddeley vaporising type. Dowty ENG. 191 Mk. 5 fuel pump. Armstrong Siddeley-Hobson flow control and distributors. Lucas Air/Fuel ratio control. Ultra two-datum jet pipe temperature control.

FUEL GRADE.—DERD. 2482 or 2486.

NOZZLE GUIDE VANES.—Cast in Nimonic 80A or Jessops G.39.

TURBINE.—Two-stage axial turbine, each disc forged in Firth Vickers Rex 448 ferritic steel and splined to shaft. First stage has N.90 blades, second stage N.80A blades, all secured by fir-tree roots. Discs splined to shaft.

JET PIPE.—Normally fixed. Variable nozzle when 12% partial afterburner fitted.

ACCESSORY DRIVE.—Drives available axially and tangentially from air casings. Accessories mounted on aircraft gearbox.

LUBRICATION SYSTEM.—Flood feed type with Armstrong Siddeley and Plessey pumps and accessories. Capacity 18 Imp. pints (10.23 litres). Minimum oil pressure, at 24% r.p.m. and above, 30 lb./sq. in. (2.11 kg./cm.²). Maximum oil pressure, at 35% r.p.m., 12 lb./sq. in. (0.84 kg./cm.²).

OIL SPECIFICATION.—DERD. 2487.

MOUNTING.—Same as for Series 100 Sapphire.

STARTING.—Rotax type C.6805 electric starter in nose fairing.

DIMENSIONS.—
Diameter 37.35 in. (948 mm.).
Length overall 132 in. (3,350 mm.).
Length overall with reheat jet-pipe 293 in. (7,440 mm.).
Frontal area 6.13 sq. ft. (0.57 m.²).

WEIGHTS.—
Dry 3,080 lb. (1,397 kg.).
Dry, with reheat jet-pipe 3,450 lb. (1,565 kg.).
Complete with accessories 3,218.75 lb. (1,460 kg.).

PERFORMANCE RATING.—
Static thrust 11,000 lb. (4,990 kg.) at sea level.
With 12% reheat 12,300 lb. (5,580 kg.) s.t.

CONSUMPTIONS.—
Fuel at take-off rating 0.885 lb./lb./hr. (0.885 kg./kg./hr.).
Oil 1 Imp. pint/hr. (0.57 litres/hr.).

THE ARMSTRONG SIDDELEY P.181/P.182.

Two versions of a 1,000 s.h.p. turbine engine are being developed by Armstrong Siddeley, one, at present designated P.181, being for rotary-wing aircraft, and the other, designated P.182, being for fixed-wing aircraft.

Both versions use the same compressor, combustion chamber and turbine assemblies, but they differ principally in the reduction gearing and final drives.

Both engines incorporate a two-stage centrifugal compressor driven by a two-stage turbine, with a free power-turbine driving the output shaft through reduction gearing suitable for the specific application of the particular engine concerned.

P.181. The output shaft of the P.181 is supported by a tubular structure from the turbine stator casing. A bifurcated engine exhaust outlet is provided. An integral oil tank is incorporated in the first-stage compressor casing, the engine lubricating system being designed to permit the engine to be installed in any angular position. Engine accessories, comprising the fuel pump, generator, tachometer, hydraulic pump, engine starter and pressure and scavenge oil pumps, are carried on the forward face of the annular intake casing. A spare drive is also available on this casing for any additional aircraft accessory which may be required.

DIMENSIONS.—
Length 85 in. (2,160 mm.).
Max. diameter 30 in. (762 mm.).
WEIGHT.—
425 lb. (193 kg.).
POWER RATINGS.—
Max. output (5 min. limit): 1,085 s.h.p.
Normal output (1 hr. limit): 920 s.h.p.
FUEL CONSUMPTION.—
0.75 lb./s.h.p./hr. (0.34 kg./s.h.p./hr.).

P.182. This engine is installed in an aircraft with the turbine end forward, thus confining the essential differences between the P.181 and the P.182 to the reduction gearing and exhaust systems. The airscrew reduction gear is driven by a shaft extending through the exhaust duct from the power turbine and is supported by a tubular structure from the turbine stator casing. Bifurcated exhaust ducts are positioned between the turbine outlet and the airscrew reduction gear and are swept outwardly and downward through the engine cowling at its forward end. A reduction gear driven from the compressor rotor provides drives for the engine accessories, which are located, as this engine is installed, at its rear end. A single air intake on top of the engine cowling supplies air to a plenum chamber formed in the cowling, which in turn feeds the rearward-facing annular engine air intake.

DIMENSIONS.—
Length 81 in. (2,057 mm.).
Max. diameter 30 in. (762 mm.).
WEIGHT.—
425 lb. (193 kg.).
POWER RATING.—
Rated output: 1,000 s.h.p. plus 200 lb. (91 kg.) residual thrust.
Equivalent h.p.: 1,075.
FUEL CONSUMPTION.—
0.74 lb./s.h.p./hr. (0.34 kg./s.h.p./hr.) or 0.68 lb./e.h.p./hr. (0.31 kg./e.h.p./hr.).

THE ARMSTRONG SIDDELEY MAMBA.

The Mamba is a turboprop engine of the straight-through flow type, of which several versions are in existence, as follows :—

ASM.1. Initial version, type-tested at a maximum power of 980 s.h.p. in February, 1948.

ASM.2. Rated at 850 s.h.p.

ASM.3. Type-tested in 1951 at power of 1,475 e.h.p. (1,310 s.h.p. plus 405 lb.= 184 kg. s.t.).

ASM.5. Rated at 1,590 e.h.p. (1,480 s.h.p. plus 295 lb.=134 kg. s.t.).

ASM.6. (Mark 110). Production version for Short Seamew. Introduced zero-stage in compressor and third turbine stage. This version is described below.

ASM.7. Designed as civil engine.

ASM.8. Uprated version of ASM.6, type-tested in 1957. No details available.

The following details refer specifically to the ASM.6 Mamba :—

TYPE.—Axial-flow Turboprop.

AIRSCREW DRIVE.—Shaft drive from compressor through compound epicyclic helical and spur reduction gearing. Standard gear ratio 0.1138 : 1. Shaft supported by one ball thrust bearing and one roller bearing.

AIR INTAKE.—Annular intake surrounding reduction-gear. Electrically-heated intake guide vanes and rubber heating mats in intake for de-icing.

COMPRESSOR.—Eleven-stage axial-flow type, made up of a series of discs on a small diameter drum. First four and last three rows have steel rotor blades; rows 5-8 have aluminium blades. First four rows have fir-tree root fixings; remainder are riveted to discs. Front and rear shafts supported in ball and roller bearings respectively. Two-piece forged aluminium-alloy casing, split horizontally, with one row of entry guide vanes, eleven rows of light-alloy stator blades and one row of outlet straightener blades dovetailed into rings.

COMBUSTION CHAMBER.—Annular type.

FUEL SYSTEM.—Armstrong Siddeley constant-speed control system. Dowty fuel pump. Armstrong Siddeley-Hobson flow control and anticipator. Rotol P.C.U. Ultra jet pipe temperature control.

FUEL GRADE.—DERD.2482, 2486 or 2488.

TURBINE.—Three-stage axial-flow type.

TAIL PIPE.—Fixed area type of stainless steel.

ACCESSORY DRIVE.—Rearward from reduction gear casing to aircraft accessory gearbox.

LUBRICATION.—Fully-scavenged type, with Armstrong Siddeley pumps. Capacity 32 Imp. pints (18.18 litres). Normal oil supply pressure: minimum 35 lb./sq. in. (2.46 kg./cm.^{2}), maximum 70 lb./sq. in. (4.92 kg./cm.^{2}).

OIL.—DERD.2487.

MOUNTING.—Six mounting bosses incorporated in centre section.

STARTING.—Rotax cartridge turbo-motor on port side of reduction gear. Provision for operating this starter on compressed air.

DIMENSIONS (ASM.6).—
Diameter 33.9 in. (861 mm.).
Length from airscrew cone fitting line to exhaust cone rear flange 61.4 in. (1,560 mm.).
WEIGHT (ASM.6).—
Dry 1,003 lb. (455 kg.).
RATING (ASM.6).—
Take-off (static) 1,650 shaft h.p. plus 320 lb. (145 kg.) jet thrust (1,770 equivalent s.h.p.) at 15,000 r.p.m. at sea level.
CONSUMPTIONS (ASM.6).—
Fuel, at take-off rating 154 Imp. gallons/hr. (700 litres/hr.).
Oil, 0.5 Imp. pint/hr. (0.28 litre/hr.).

THE ARMSTRONG SIDDELEY DOUBLE MAMBA.

The Double Mamba, which powers the Fairey Gannet anti-submarine aircraft, consists basically of two Mamba engines placed side-by-side and driving two contra-rotating co-axial airscrews. Although the two engines are joined together at the front end and use the same air intake and airscrew-shaft gear casing, they are otherwise two quite separate power-units. Each has its own fuel, lubrication and control systems, its own reduction-gear and each drives one of the two co-axial airscrews. Each engine can be stopped, started, cruised or feathered under conditions entirely separate from the other.

The following versions have been announced :—

ASMD.1. Made up of two ASM.3 units. Rated at 2,850 e.s.h.p. (2,620 s.h.p. plus 810 lb.=368 kg. s.t.).

ASMD.3. Made up of two ASM.5 units. This engine is described below.

ASMD.4. Made up of two ASM.6 units. Completely new forward end, with lower thrust line. Rated output 3,300 s.h.p. plus 640 lb. (290 kg.) s.t.

ASMD.8. Made up of two ASM.8 units. Lower thrust line than ASMD.1 and 3. Rated output 3,850 e.h.p. (3,600 s.h.p. plus 710 lb.=322 kg. s.t.). In production.

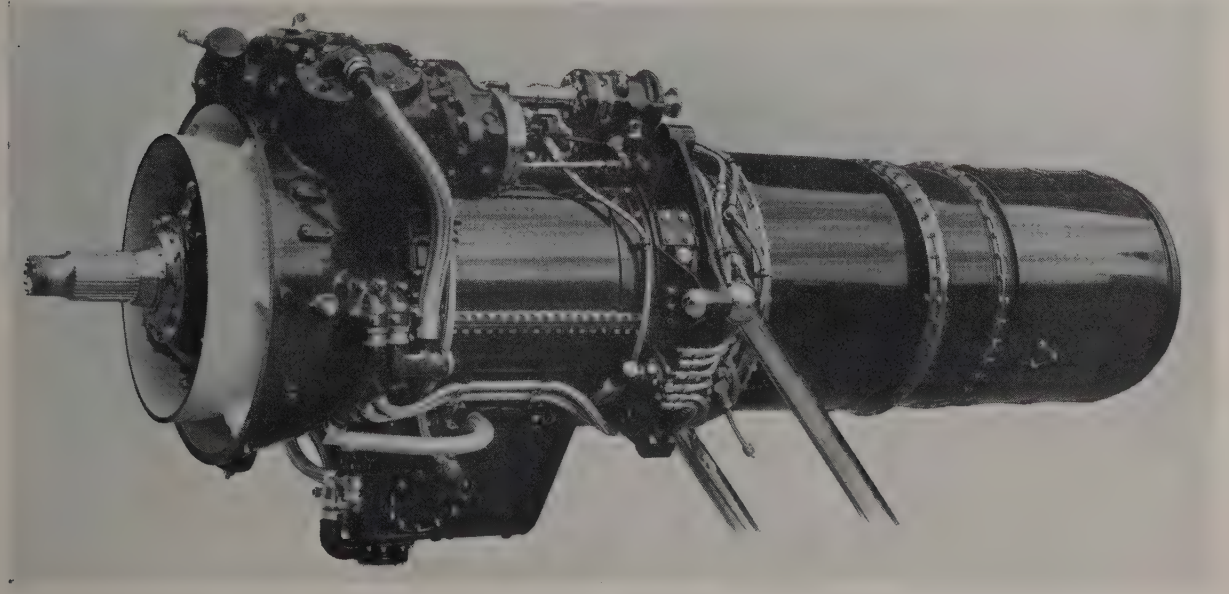
The two engines in each version are standard Mambas and the description which follows is only concerned with the components which are peculiar to the Double Mamba ASMD.3 version.

TYPE.—Dual Turboprop made up of two Mamba engines, each driving independently one of two co-axial airscrew shafts.

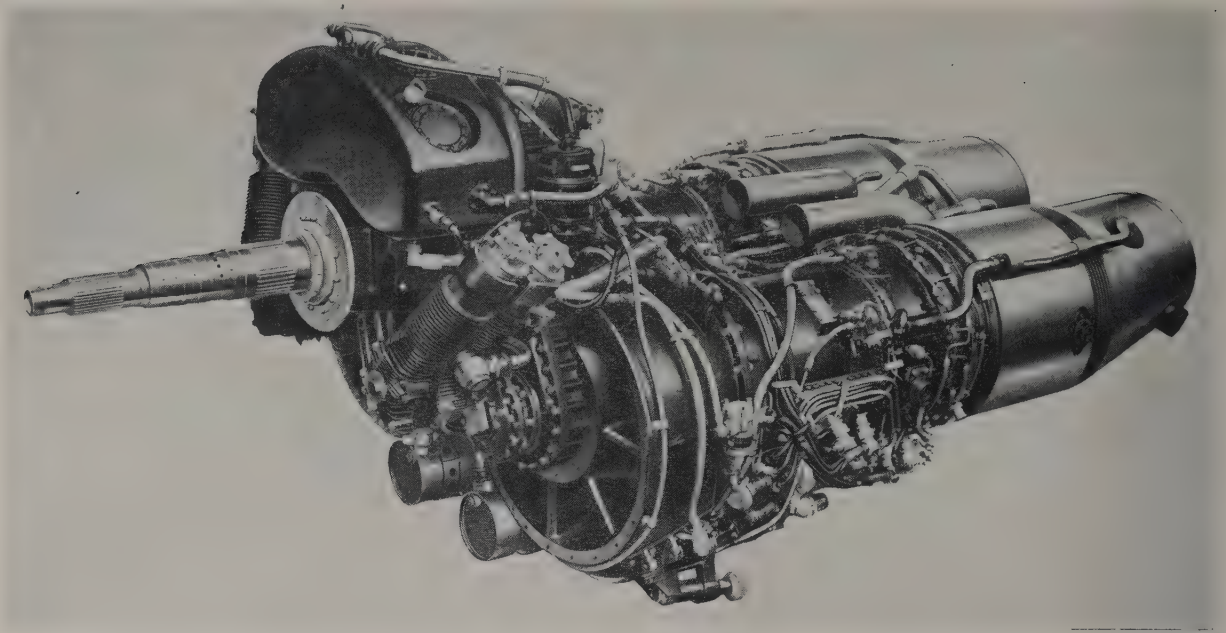
COMPRESSORS, COMBUSTION CHAMBERS, TURBINES.—As for Mamba.

FRONT CASING.—Two Mamba engines without their individual reduction gears mounted on front casing which houses epicyclic and simple gear trains in coupling gears, and drives for engine auxiliaries and aircraft accessory gear box. Each airscrew shaft has its separate train of gears and a roller clutch to prevent rotation during flight when either airscrew is feathered. A free-wheel arrangement enables either unit to drive the aircraft accessories drive-shaft. Casing consists of three main magnesium castings containing the reduction gearing and air passages from kidney-shaped air entries to an annulus before the compressors. Electrically-heated inlet guide vanes and rubber heater mats for de-icing. Inlet air flow 35 lb./sec. (15.87 kg./sec.).

AIRSCREW DRIVE.—Two co-axial independent airscrew shafts, sizes S.B.A.C. No. 4 (front) and No. 6 (rear). Planetary and spur



The Armstrong Siddeley Mamba ASM.5 turboprop engine (1,480 s.h.p. plus 295 lb.=134 kg. jet thrust).



The Armstrong Siddeley Double Mamba ASMD.3 turboprop engine (2,800 s.h.p. plus 595 lb.=270 kg. jet thrust).

type reduction gear, ratio 0.0965 : 1 (10.36 : 1), driven from compressors. Torquemeters and airscrew brakes are incorporated. Shafts, whose centre-lines are 11 in. (27.9 cm.) above those of the two engine units, supported by ball and roller bearings. Provision for Rotol eight-blade constant-speed feathering and braking airscrew.

FUEL SYSTEM.—Each engine component has its individual system as for Mamba.

FUEL GRADE.—DERD.2482, 2486 or 2488.

ACCESSORY DRIVES.—Rotol gearbox mounted above air intake casing and driven by shaft which is geared to both airscrew shafts, an idler being inserted to obtain correct direction of rotation. Free-wheel assembly provided to avoid connected drive between two components. Drive can transmit up to 100 h.p. at maximum r.p.m. and full power is available when either engine is feathered.

LUBRICATION.—Separate system for each half as for Mamba ASM.3. Each gear train in reduction gear is lubricated with oil from driving engine.

OIL.—DERD.2479/1.

MOUNTING.—Three-point suspension. One point above reduction gear and two below gear.

DIMENSIONS (ASMD.3). –
Width 52.8 in. (1,341 mm.).
Length from airscrew cone abutment face to exhaust cone rear flange 98.67 in. (2,506 mm.).

DIMENSIONS (ASMD.8).—
Width 56.55 in. (1,435 mm.).
Height 45.28 in. (1,150 mm.).
Length 109.7 in. (2,785 mm.).

WEIGHTS (ASMD.3—Mk. 101).—
Dry 2,180 lb. (989 kg.).
Complete with accessories 2,282 lb. (1,035 kg.).

RATINGS (ASMD.3).—
Take-off (static) 2,800 shaft h.p. + 595 lb. (270 kg.) jet thrust at 15,000 r.p.m.

CONSUMPTIONS (ASMD.3).—
Fuel at take-off rating 287 Imp. gallons/hr. (1,304 litres/hr.).

THE ARMSTRONG SIDDELEY VIPER.

The Viper turbojet was originally designed for "short-life" full-throttle operation in expendable aircraft such as the Australian Jindivik pilotless target aircraft, for which the Viper ASV.3 was produced.

In order to reduce cost this version was simplified as far as practicable and, consistent with its short but active life, only the most economical low grade materials were used in its construction.

The number of accessories was reduced to two assemblies for the ASV.3, a combined fuel and oil pump assembly and a fuel flow control.

As a result of the success and overall efficiency of the "short-life" Viper, a "long-life" version was developed for use in the Hunting Percival Jet Provost and other piloted aircraft. This engine retains much of the desirable simplicity of the "short-life" engine, but has been modified in various respects in order to give an overhaul life equal to that of any other conventional aero-engine.

The following versions of the Viper have been announced :—

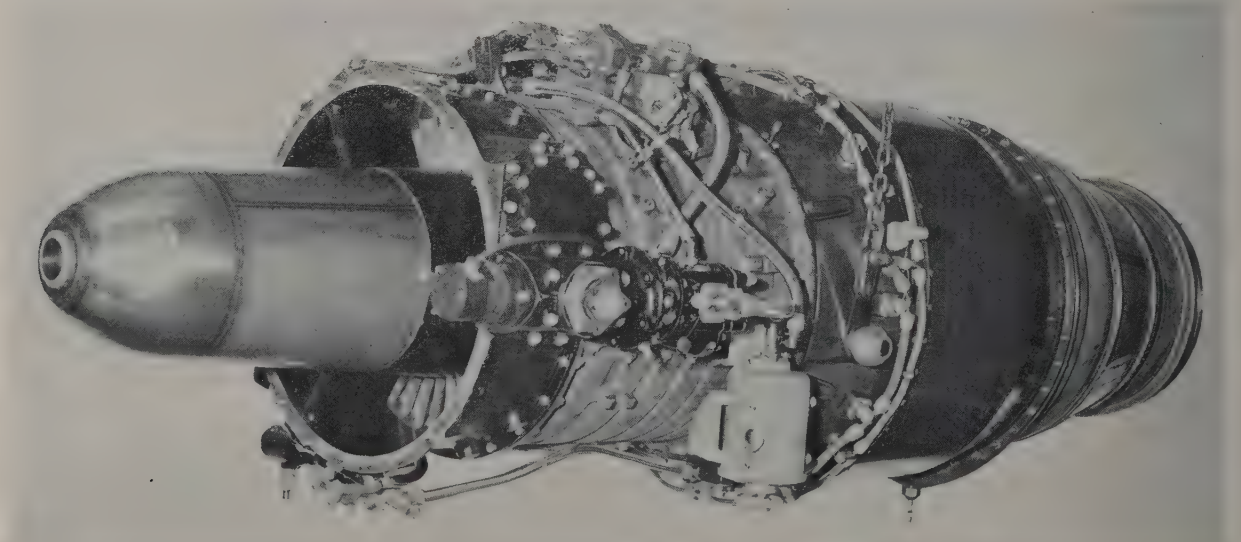
ASV.1. Initial "short-life" design study. Rated at 1,145 lb. (520 kg.) s.t. Not built.

ASV.2. Developed "short-life" version. First run in April, 1951. Type-tested at 1,500 lb. (680 kg.) s.t.

ASV.3 (Mark 100). Production "short-life" version for Jindivik pilotless target aircraft, as Viper Mk. 100. First flight-tested in tail of Lancaster test-bed in November, 1952. Type-tested at 1,640 lb. (745 kg.) s.t. Production completed.

ASV.4. "Short-life" development of ASV.3, rated at 1,750 lb. (795 kg.) s.t. First run in 1952.

ASV.5. Production "long-life" version for Hunting Percival Jet Provost T. Mk. 1 and Folland Midge. Type-tested at



The Armstrong Siddeley Viper ASV.8 turbojet engine (1,750 lb.=795 kg. s.t.).

1,640 lb. (745 kg.) s.t. First run in November, 1953. Produced as Viper Mk. 101.

ASV.6. "Short-life" version, rated at 1,900 lb. (860 kg.) s.t. First run in 1952.

ASV.7R. "Long-life" turbojet, with reheat, rated at 2,470 lb. (1,120 kg.) s.t.

ASV.8. "Long-life" version, type-tested at 1,750 lb. (795 kg.) s.t. Powers Hunting Percival Jet Provost T. Mk. 2 as Viper Mk. 102.

ASV.9. "Long-life" version similar to ASV.8 except for turbine materials. Rated at 1,900 lb. (862 kg.) s.t. Produced as Viper Mk. 103.

ASV.10. "Long-life" version. Redesigned compressor, similar to that of the latest Sapphires, with the blades mounted on discs carried on a central drum and a Sapphire-type combustion chamber backplate with 24 burners. Its mass flow is increased to 42 lb. (19.05 kg.) per sec. at 13,400 r.p.m. Rated at 2,000 lb. (907 kg.) s.t. First ran in January, 1956.

ASV.11. "Long-life" version, similar to ASV.10 but rating increased to 2,460 lb. (1,116 kg.) s.t. by increased mass flow and running at higher peak temperatures.

P.187. Developed from the ASV.11, this version has been reduced in weight by 70 lb. (31.75 kg.) by use of Fibreglass blades on the first compressor stage and magnesium-zirconium alloy for the centre section. It is rated at 2,500 lb. (1,135 kg.) s.t.

A licence for the production of the Viper in France has been acquired by the Dassault company by whom it is called the M.D.30 Viper. This company has developed its own afterburner unit and the version fitted with this is known as the M.D.30R.

The M.D.30 Viper is currently flying in the S.O. 9000 and 9050 Trident jet and rocket-powered supersonic research monoplanes, a Viper engine being mounted at each wing-tip.

Another French mixed power plant aircraft is the Dassault M.D.550 Mirage I which is also powered by two M.D.30 Vipers and a liquid-fuel rocket motor.

The Dassault Company have developed a further version of the Viper, known as the ASD.100 or R.7. This is a straightforward scaled-up version of the ASV.10 and will have a Dassault afterburner capable of augmenting the thrust by 30%.

The following details apply to the Viper ASV.8 and 9, but are generally applicable to other "long-life" versions :—

TYPE.—Axial-flow Turbojet.

AIR INTAKE.—Annular type at front of engine. Anti-icing by electrically-heated intake guide vanes and air intake heater mats. Inlet air flow 32 lb./sec. (14.5 kg./sec.).

COMPRESSOR.—Seven-stage axial-flow, of disc-type construction. Discs of aluminium alloy bolted to front and rear stubshafts. Total of 400 stator blades made from R.R.57 aluminium alloy. Total of 463 rotor blades, the first row made of S.62 stainless steel and the remainder of R.R.57 aluminium alloy. Stator blades dovetailed direct into grooves in casing with resin fixative. Rotor blades tongued and grooved between adjacent discs. Compressor shaft carried in front ball combined thrust and journal bearing and rear parallel roller bearing. Compressor casing cast in top and bottom halves in L.51 aluminium alloy, bolted together.

COMBUSTION CHAMBER.—Single annular type with outer casings of chromium nickel non-corrosive steel and inner flame tubes of chromium-nickel heat-resisting steel, between which combustion takes place. Fuel and primary air fed into 12 pairs of hook-shape Armstrong Siddeley vaporiser tubes whose open ends point upstream. B.T.H. high energy ignition system with two diametrically-opposed Lodge igniter plugs.

FUEL SYSTEM.—Low-pressure vaporising type. Pressure of 616 lb./sq. in. (43.3 kg./cm.²) at burners supplied by Lucas G.B.B. pump. Armstrong Siddeley-Hobson flow control and Lucas air-fuel ratio control.

FUEL GRADE.—DERD.2482 or 2486.

NOZZLE GUIDE VANES.—Single row of 93 blades, made from Nimonic 80, retained in inner and outer sheet metal rings.

TURBINE.—Single-stage axial-flow turbine. Disc of Rex 448 or G.46 steel, with peripheral "fir-tree" slots to retain the 113 blades, which are made from Nimonic 90. Turbine disc is located on mainshaft by a bolt and Hirth-type coupling. Single-row roller bearing ahead of disc. Gas temperature before turbine 840°C., after turbine 707°C.

JET PIPE.—Fixed type. Chromium nickel non-corrosive steel cone.

ACCESSORY DRIVE.—Via bevel gearing from front of compressor shaft, via intake spoke. Accessories mounted on aircraft gearbox.

LUBRICATION SYSTEM.—Flood feed to front bearing and gearcase. Micro-pump total loss feed to centre and rear bearings. Tecalemit plunger pumps. Oil capacity 14 pints (7.95 litres). Normal oil supply pressure 30 lb./sq. in. (2.11 kg./cm.²).

OIL SPECIFICATION.—DERD.2487.

MOUNTING.—Two trunnions at mid-length of engine, with steady point on air intake flange.

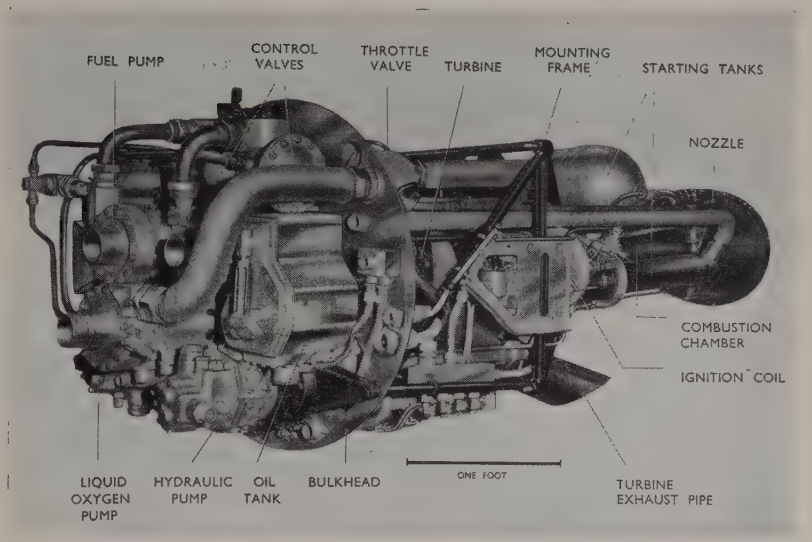
STARTING.—Rotax electric starter or L.P. air starting by impingement on turbine blades.

DIMENSIONS (ASV.8 and 9).—
Diameter 24.03 in. (610 mm.).
Length 82.5 in. (2,095 mm.).
Frontal area 261.6 sq. in. (1,688 cm.²).

WEIGHTS.—
ASV.5, complete with accessories 515 lb. (234 kg.).
ASV.8 and 9, dry 525 lb. (238 kg.).
ASV.10, complete with accessories 570 lb. (259 kg.).

PERFORMANCE RATINGS.—
ASV.5 take-off (static) 1,640 lb. (745 kg.) at 13,400 r.p.m.
ASV.8 take-off (static) 1,750 lb. (795 kg.) at 13,800 r.p.m.
ASV.9 take-off (static) 1,900 lb. (862 kg.) at 13,800 r.p.m.
ASV.10 take-off (static) 2,000 lb. (907 kg.) at 13,800 r.p.m.
ASV.11 take-off (static) 2,460 lb. (1,116 kg.)

CONSUMPTIONS.—
ASV.5 fuel 1.09 lb./lb. s.t./hr. (1.09 kg./kg. s.t./hr.).
ASV.8 and 9 fuel 1.12 lb./lb. s.t./hr. (1.12 kg./kg. s.t./hr.).
ASV.10 fuel 1.01 lb./lb. s.t./hr. (1.01 kg./kg. s.t./hr.).
ASV.8 and 9 oil 1 pint/hr. (0.57 litres/hr.).



The Armstrong Siddeley Screamer Liquid Tri-propellent Rocket.

THE ARMSTRONG SIDDELEY SCREAMER.

As originally conceived in 1950, the Screamer was to be a 4,000 lb. (1,815 kg.) thrust rocket engine, suitable for powering a supersonic interceptor and using liquid oxygen and methanol propellents. Subsequently, the thrust requirement increased considerably and a change from methanol to kerosene or wide-cut gasoline fuel was specified. It was also decided to feed water into the combustion chamber as a third propellent for cooling purposes.

Bench running of a complete engine started in March, 1954 and in September, 1954 a Screamer ASSc. 1-2 ran at a thrust of 8,000 lb. (3,630 kg.). By December, 1955, when the ASSc. 2-1 version was given flight clearance for testing in a Meteor airframe, Screamers had completed more than 1,350 firings, totalling some 36 hours' running time. The following description applies to the projected production version.

TYPE.—Liquid tri-propellent Rocket.

PUMPS.—Liquid oxygen pump (23 lb.=10.43 kg./sec.), fuel pump (9 lb.=4.08 kg./sec.) and water pump (5 lb.=2.27 kg./sec.) mounted on turbine-driven gearbox at front of engine.

TURBINE.—Single stage axial-flow impulse turbine of supersonic Laval type, driven by a gas-generator. Forty-three Nimonic 80 blades secured by "fir tree" roots in a Rex 448 steel disc. Delivers 350 s.h.p. at 20,000 r.p.m.

GAS GENERATOR.—Like a miniature combustion chamber, surrounded by water-cooling jacket. High-frequency plugs. Burns liquid oxygen and gasoline to give mass flow of approximately 2 lb./sec. (.90 kg./sec.) gas at 625°C. to turbine.

COMBUSTION CHAMBER.—Throatless type, having double wall with scrolls to circulate cooling water, some of which is injected into chamber as a third propellent. Made in two portions, from S.21 mild steel, bolted together at junction of cylindrical and cone-shaped portions. Inner shell hard-chrome-plated. Other parts cadmium-plated. Flat back-plate machined from S.110 steel drilled with radial or concentric rows of injection holes for liquid oxygen and gasoline propellents. High-frequency ignition. Working pressure 600 lb./sq. in. (422 kg./cm.²). Expansion ratio 90 : 1. Mass flow 36.84 lb./sec. (16.71 kg./sec.).

PROPELLENTS.—At sea level, liquid oxygen 60%, wide-cut gasoline (D.E.R.D. 2486) 23%, water 17%, fed from three steel starting tanks, each pressurised to 450 lb./sq. in. (31.64 kg./cm.²) by a 3,000 lb./sq. in. (210 kg./cm.²) nitrogen bottle.

MOUNTING.—Four circumferentially-located mounting points on main framework of welded T.45 steel tubes.

DIMENSIONS.—
Diameter overall 27 in. (685 mm.).
Length overall 78.5 in. (1,994 mm.).

WEIGHT.—
Dry 470 lb. (213 kg.).

PERFORMANCE.—
Static thrust at S/L. 1,000-8,000 lb. (455-3,630 kg.).
Max. thrust at 40,000 ft. (12,200 m.) approx. 9,500 lb. (4,310 kg.).
Specific impulse at S/L. 217 sec.
Jet velocity 7,000 ft./sec. (2,135 m./sec.).

BLACKBURN-TURBOMECA

BLACKBURN & GENERAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS, ENGINE DIVISION: BROUGH, E. YORKS.

LONDON OFFICE: 43, BERKELEY SQUARE, W.1.

Directors: E. Turner, A.C.A. (Chairman and Managing Director); Major F. R. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S.; N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., Whit.Ex., F.R.Ae.S.; Sir Maurice Bonham Carter, K.C.B., K.C.V.O.; Marshal of the Royal Air Force Sir John Slessor, G.C.B., D.S.O., M.C.; Air Vice-Marshal H. N. Thornton, C.B.E.; T. Bancroft and A. F. Jopling.

General Manager: J. B. Bucher, Dip. Ing., M.I.Mech.E., M.I.E.S., M.I.S.I.

Secretary: R. H. Stone, A.C.A.

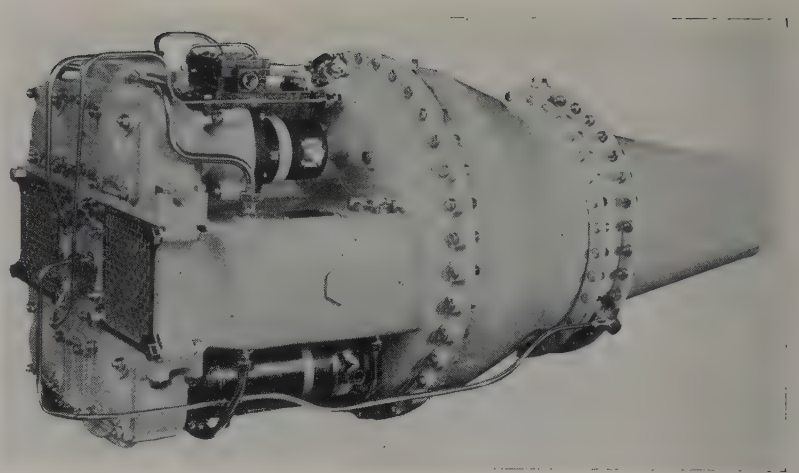
Sales Manager: Group Capt. H. J. Wilson, C.B.E., A.F.C.

Blackburn & General Aircraft, Ltd. hold the exclusive manufacturing and selling rights in the United Kingdom and most of the British Commonwealth for the French-designed Turbomeca gas-turbine engines.

Blackburn has redesigned the first group of engines on which it is at present concentrating, various modifications having been embodied in order to meet British requirements and to simplify production. The Blackburn Turbomeca engines will be known as the 500 and 600 Series, the 500 Series engines having their mass flow reduced to approximately two-thirds of that of the 600 Series.

The 500/600 Series engines, which have a maximum number of interchangeable parts, can be divided into three main categories, namely pure jet engines (Palas), shaft turbines (Artouste and Turmo) and air compressors (Palouste). The Palas, which is the basic engine in the range, is suitable for installation in small pure jet aircraft, such as trainers and target aircraft. The other units have a variety of uses, the most obvious being as helicopter power-units.

Full details of the French Turbomeca range of gas-turbine engines will be found under "Turbomeca" (France).



The Blackburn-Turbomeca Palas Turbojet engine (390 lb.=177 kg. s.t.).

THE BLACKBURN-TURBOMECA PALAS.

The Palas is a small turbojet engine with a single-stage centrifugal compressor, an annular combustion chamber with a rotary fuel injector and a single-stage turbine.

The fuel system comprises a Plessey gear-type pump fitted to a Lucas control system which supplies fuel to the rotary injector, from which it is vented by centrifugal force.

A centrifugal governor is arranged to control both the idling and the higher engine speeds, while at low thrust settings the hand throttle controls the speed. A single-lever throttle control effects all these operations.

A torch igniter of Blackburn design, supplied with fuel from the main engine pump and using a high-energy spark unit or a booster coil, is employed to ignite the fuel on starting.

The oil system consists of a pressure-type oil pump feeding the bearings, together with two scavenge pumps. The oil tanks are cast integral with the intakes.

The nose casting, with bifurcated air intakes, which is common to all engines in the Blackburn-Turbomeca range, has been completely re-designed to enable all auxiliaries to be mounted within the diameter of the engine. Eight standard flanges are provided for normal auxiliaries and four for fuel and oil pumps. The flanges are interchangeable so that they can be arranged in any position, and all are readily accessible.

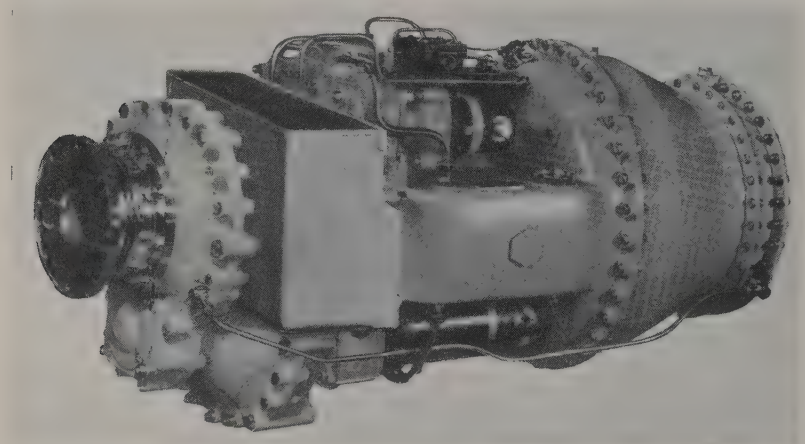
The following particulars relate to the Palas 600 Series engine, with which Blackburn completed successfully an official "1,000-start" Type Test in 1957 :—

DIMENSIONS.—
Overall length 43.8 in. (111 cm.).
Max. diameter 17.5 in. (44.5 cm.).

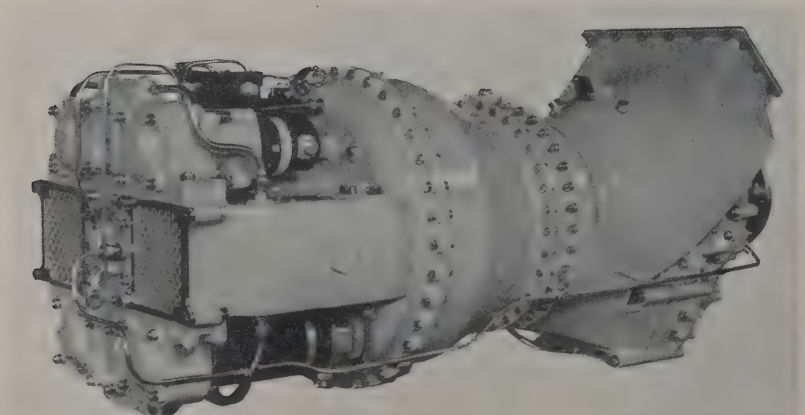
NET DRY WEIGHT.—
168 lb. (76 kg.).

PERFORMANCE RATINGS.—
Take-off (static) 390 lb. (177 kg.).
Max. continuous 338 lb. (133 kg.).

FUEL CONSUMPTION.—
Take-off 1.20 lb./lb. s.t./hr. (1.20 kg./kg. s.t./hr.).
Max. continuous 1.14 lb./lb. s.t./hr. (1.14 kg./kg. s.t./hr.).



The Blackburn-Turbomeca Turmo shaft turbine.



The Blackburn-Turbomeca Artouste shaft turbine.

THE BLACKBURN-TURBOMECA TURMO 600.

The Turmo is a shaft turbine in which the exhaust gases of a Palas unit minus jet pipe drive a free turbine which, in turn, drives an output shaft at the rear of the engine through a reduction gear.

The same range of reduction-gear ratios is available as in the Artouste and additional gearing can be incorporated to fit the engine to the needs of fixed-wing or rotary-wing aircraft.

Two Blackburn-produced Turmos have been purchased by the Kaman Aircraft Corporation of Bloomfield, Connecticut, and will be fitted in the K-600-4 version of their K-600 helicopter, for evaluation by the Canadian military services. Coupling of the engines is being undertaken by Kaman.

DIMENSIONS.—
Length overall 52.2 in. (133 cm.).
Width overall 21.5 in. (55 cm.).
Height overall 18.75 in. (48 cm.).

NET DRY WEIGHT.—
310 lb. (141 kg.).

POWER RATINGS.—
Air Mass flow 7.19 lb./sec. (3.26 kg./sec.).
Max. power output 450 h.p.
Max. continuous output 400 h.p.

THE BLACKBURN-TURBOMECA ARTOUSTE 600 and 610.

The Artouste is a shaft turbine in which the power output shaft is directly coupled to the compressor of a Palas powor unit. In this unit, however, a two-stage turbine is used, part of the power from which drives the compressor, the remaining power being available to drive the power take-off shaft through a reduction gear (of which three ratios are available) on the front of the engine.

One application of the Artouste, which has been developed under Ministry of Supply contract, is as an airborne auxiliary power-plant for large military aircraft. It is designated the BnA.1.

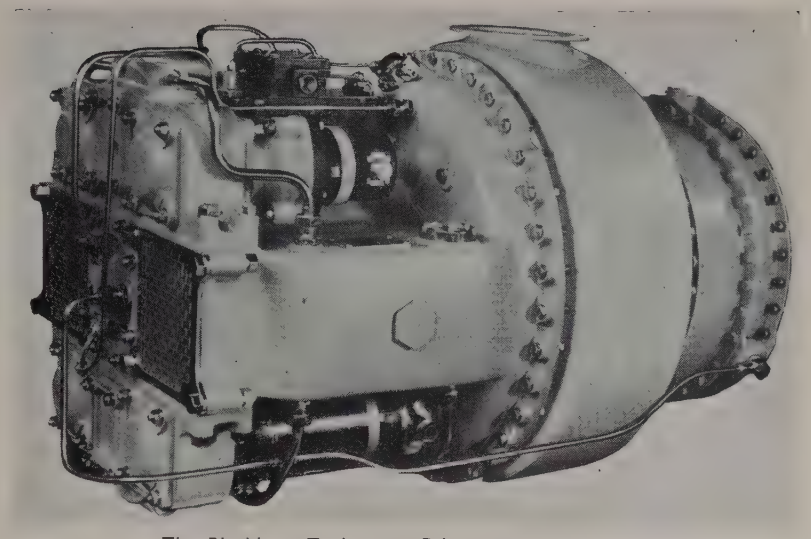
DIMENSIONS.—
Length overall 44 in. (112 cm.).
Width overall 19.25 in. (49 cm.).
Height overall 19.25 in. (49 cm.).

NET DRY WEIGHT.—
306 lb. (139 kg.).

POWER RATINGS (Artouste 600).—
Air mass flow 7.19 lb./sec. (3.26 kg./sec.).
Max. power output 475 s.h.p. plus 64 lb. (29 kg.) jet thrust.
Max. continuous output 415 h.p.

THE BLACKBURN-TURBOMECA PALOUSTE 500.

The Palouste is an air generator which, as its name implies, is made up of components of the Palas and Artouste. An oversize compressor delivers to the combustion chamber a greater quantity of air than the two-stage turbine can utilise. The combustion chamber has a double wall, the inner wall being perforated to permit the surplus compressed air to be bled off. An air delivery flange is located on top of the combustion chamber casing.



The Blackburn-Turbomeca Palouste air generator.

The Palouste is installed in the Fairey Ultra-light helicopter, providing compressed air to the pressure jets at the tips of the rotor blades. Blackburn also have an Admiralty contract for development of this engine in an air starter trolley and airborne pod. The military versions, designated BnPe.2 and 3, are rated at 258 gas h.p.

The Palouste has a maximum free air output of 2.725 lb./sec. (1.24 kg./sec.) at 41.55 lb./sq. in. (2.92 kg./cm.²).

DIMENSIONS.—
Overall length 33 in. (84 cm.).
Max. diameter 18 in. (46 cm.).

NET DRY WEIGHT.—
206 lb. (93.5 kg.).

BRISTOL

BRISTOL AERO-ENGINES, LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, NR. BRISTOL.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, LONDON, S.W.1.

Directors: Sir W. Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Chairman and Managing Director); Sir W. Reginald Verdon Smith, M.A., B.C.L., J.P.; Brian Davidson; F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E., F.Inst.Pet.; Dr. S. G. Hooker, O.B.E., D.Phil., D.I.C., F.R.Ae.S. (Chief Engineer); G. L. Hack, M.I.Mech.E. (Works Director); John Innes, O.B.E. (Business Director); R. L. Ninnes, F.R.Ae.S.; Dr. E. Warlow Davies, D.Phil., B.A., B.Sc. (Deputy Chief Engineer); F. M. Burns (Financial Director).

General Manager: D. A. Fairnie, B.Sc., M.I.Prod.E.

Secretary: D. Railton.

With the progressive growth of the company's aviation activities at home and abroad, the Bristol Aeroplane Co., Ltd. decided late in 1955 to transfer the activities of its individual divisions to the control of separate subsidiary companies. As part of this reorganisation a new company known as Bristol Aero-Engines, Ltd. was incorporated. It took over the assets and liabilities of the Aero-Engine Division on January 1, 1956.

In addition to the headquarters factory at Filton, the company has a components factory at Sunderland, overhaul base at Whitchurch and satellite drawing offices in London and Cardiff.

The first Proteus turboprop ran in 1947 and was followed two years later by the coupled Proteus. Continuous development produced the Proteus 600 (single) and 610 (coupled) engines which were fitted in the Princess flying-boat, and Proteus 625 engines which were used in the prototype Britannia airliner.

The further-developed Proteus 705, which powers the Britannia 102 in service with B.O.A.C., first ran in 1952. A more powerful version of this engine is the Proteus 755, which is rated at 4,120 e.s.h.p. and is the power unit of the Britannia 250, 300 and 310 series.

In the field of power units for civil aircraft Bristol Aero-Engines is also engaged on development of the Orion supercharged turboprop engine. This is a constant-power engine which is able to maintain its full sea-level power output for take-off from almost any aerodrome in the world, irrespective of its elevation or the prevailing temperature. It is specified for later versions of the Britannia and for the Canadair CL-44 (CC-106) transport which has been ordered for the R.C.A.F.

The first Bristol turbojet, the Olympus, employs a compounded, or "two-spool," compressor system. On August 29, 1955, a Canberra, powered for development purposes by two Olympus 102 engines, established a new World's Altitude Record for aeroplanes of 65,890 ft. (20,083 m.). Versions of the Olympus power the Avro Vulcan bomber.

The Bristol company announced early in 1954 that it was developing a single-spool lightweight turbojet to be known as the Orpheus, and this engine ran for the first time on December 17, 1954. Within less than five months the initial version had completed a 150-hours Type Test at 3,285 lb. (1,490 kg.) s.t.—giving a thrust/weight ratio of 4.4 lb. s.t. per lb. weight (4.4 kg. s.t. per kg. weight).

Now developing up to 6,810 lb. (3,089 kg.) s.t. in its production form, the Orpheus powers the Folland Gnat, Fiat G-91, Dassault Etendard VI, Breguet 1001 Taon, Aerfer Leone and Hispano HA 300 fighters, the Fuji T1F1 trainer, and other aircraft of which no details may be published.

Bristol is also developing supersonic ramjets for a wide range of applications, especially in the guided missile field.

The first ramjet to go into production in the United Kingdom was the Bristol Thor, and ramjets of this type power the Bristol/Ferranti Bloodhound surface-to-air missile.

Bristol holds licences to manufacture afterburners and associated equipment designed and developed by the Solar Aircraft Company of San Diego, California, and the thrust-reversing system developed by the French SNECMA company.

The Curtiss-Wright Corporation has collaborated with Bristol over a long period in connection with the production of Bristol gas-turbine engines in the United States, and in July, 1957 there was announced a new agreement concerning a civil version of the Olympus turbojet, known as the Zephyr, which is intended "for jet transport aircraft for all weather operation" out of present commercial airports.

In November, 1956 it was announced that the Indian Government had concluded an agreement with Bristol Aero-Engines Ltd. covering the manufacture in India of the whole range of Orpheus engines. The Orpheus will be built at Bangalore, and the first application for Indian-built Orpheus engines will be in the Folland Gnat, which is to be built under licence by Hindustan Aircraft Ltd.

Fiat SpA of Turin also have a technical collaboration agreement with Bristol Aero-Engines, with an option to manufacture the Orpheus in Italy.

THE BRISTOL B.E.47.

First announced early in 1957, the B.E.47 is a medium-power turbojet with a rating of 6,000-8,000 lb. (2,722-3,630 kg.) s.t. No details are available.

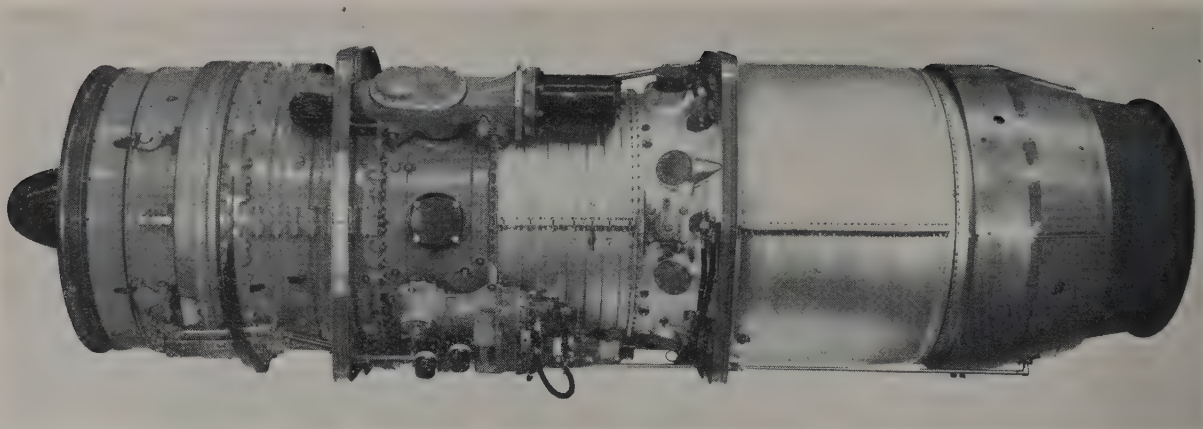
THE BRISTOL OLYMPUS

The Olympus was the first British turbojet engine of the "compound" or "two-spool" type.

The engine consists basically of a low-pressure system and a high-pressure system. The high-pressure system has a compressor, combustion section and turbine, and may therefore be thought of as a complete gas-turbine engine. On an entirely separate shaft, the low-pressure system has a compressor fed from the atmosphere and delivering to the H.P. compressor.

The low-pressure compressor is driven by a low-pressure turbine which receives gas from the H.P. turbine and discharges to the jet pipe. By strict analogy the L.P. section therefore acts as an exhaust-driven supercharger for the H.P. section.

In this way, a high pressure ratio can be achieved while retaining ease of starting and handling as good as that of the best single-shaft low-pressure-ratio engine,



The Bristol Olympus BOl.6 turbojet engine (16,000 lb.=7,260 kg. s.t.).

which results in exceptional power and fuel economy for the weight and size of the engine. This is especially the case at high altitudes, as evidenced by the fact that an Olympus-powered Canberra established successive World's Altitude Records in May, 1953 and August, 1955.

Several versions of the Olympus have been announced, as follows :—

BOl.1. Initial version with S/L. rating of 9,140 lb. (4,146 kg.). First bench-tested on May 6, 1950, but only limited development.

BOl.2. Development of BOl.1 with larger turbine and modified compressor. Designed to give 9,750 lb. (4,423 kg.) s.t. Not built.

BOl.1/2. Development of BOl.2, first run in November, 1950.

BOl.1/2A. Modified version of BOl.1/2 to meet requirements of Curtiss-Wright, holders of U.S. licence. Rated at 9,750 lb. (4,423 kg.) s.t., with compression ratio of 9 : 1 and air mass flow of 165 lb./sec. (75 kg./sec.).

BOl.1/2B (Mk. 100). First version of Olympus to be test flown, in a modified Canberra B.2 aircraft on August 5, 1952. Accessories moved forward from delivery casing of H.P. compressor to intermediate casing. Tested initially in de-rated (8,000 lb.=3,629 kg. s.t.) form as Olympus Mk. 99. Slightly modified Mk. 100 version (9,250 lb.=4,196 kg. s.t.) powered second prototype Avro Vulcan, first flown in September, 1953. Rated power 9,750 lb. (4,423 kg.) s.t.

BOl.1/2C (Mk. 101). First version of the Olympus to enter full production. Flight tested in a Canberra in June, 1954. Type-tested at a rating of 11,000 lb. (4,990 kg.) s.t. in December, 1954. Similar to the BOl.1/2B except for larger-diameter turbine casing.

BOl.6 (Mk. 200). First of a new series of Olympus turbojets. Type tested at a rating of 16,000 lb. (7,260 kg.) s.t. in January, 1957, thrusts of over 17,300 lb. (7,846 kg.) being recorded during the test. Extensively redesigned and smaller in diameter than earlier versions. Claimed to have the highest thrust/weight ratio of any high-thrust turbojet, combined with very low specific fuel consumption. In production for Avro Vulcan B.2 as Olympus Mk. 200.

BOl.11. (Mk. 102). Similar externally to the Mk. 101, from which it has been developed. In full production for the Avro Vulcan. It was announced in February, 1956 that this engine had been type tested at a rating of 12,000 lb. (5,443 kg.) s.t. Two Olympus Mk. 102 engines were fitted in the Canberra which established a World's Height Record for aeroplanes of 65,890 ft. (20,083 m.) in August, 1955.

BOl.12 (Mk. 104). Announced in March, 1957 after being type-tested at rating of 13,000 lb. (5,897 kg.) s.t. in December, 1956. Engines of Mk. 101 and Mk. 102 type can be converted to Mk. 104 standard on overhaul at relatively small cost.

Since 1955, Solar Aircraft of San Diego, U.S.A., have been assisting in the design and development of reheat systems for the Olympus and other Bristol turbojets. A Series 100 Olympus completed in 1957 the equivalent of a 150-hour type test with a Solar reheat system giving a 40% increased thrust. Thrust and nozzle area can be varied continuously and progressively.

The following data apply specifically to the Olympus BOl.1 :—

TYPE.—Axial-flow "two spool" turbojet.

AIR INTAKE.—Two-piece casting in ZRE-1 magnesium-zirconium alloy surrounding the housing for the front compressor shaft bearing.

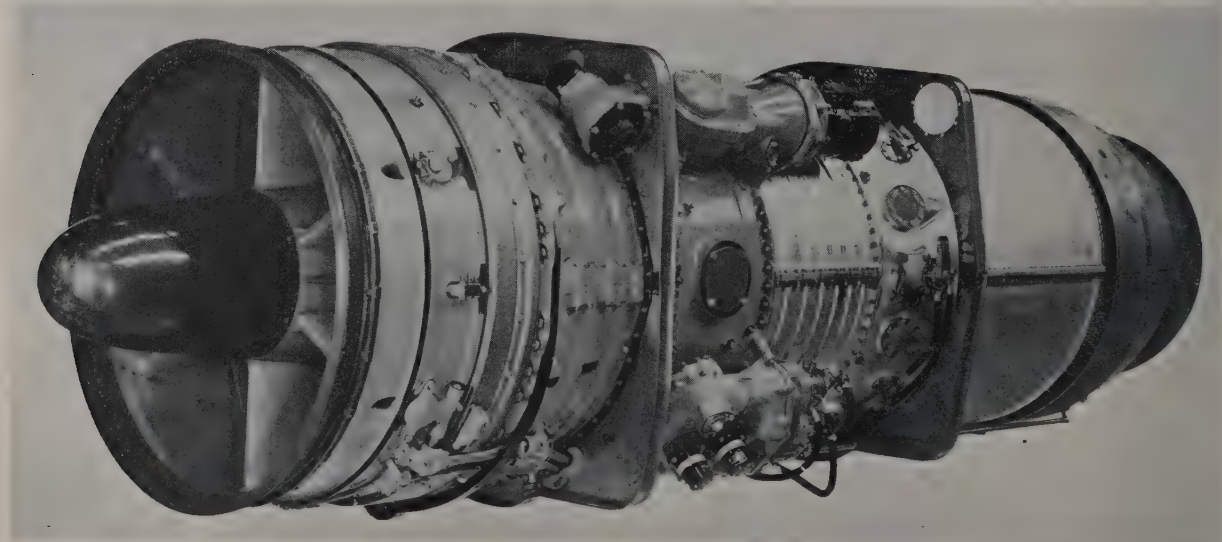
L.P. COMPRESSOR.—Six-stage axial-flow type. Forged RR.57 aluminium alloy rotor blades attached by "fir tree" roots to the six RR.58 rotor discs which are clamped between two S.96 steel end-discs. Fabricated RR.57 inlet guide vanes of fixed incidence. Forged RR.58 stator blades and exit guide vanes (first row RR.58, second row RR.57) are mounted in taper grooves in two-piece ZRE-1 stator casing. Shaft carried on front roller bearing and rear stack ball bearing.

INTERMEDIATE CASING.—A ZRE-1 casting, carrying certain of the accessory drives in early engines and all accessory drives from BOl.1/2B on.

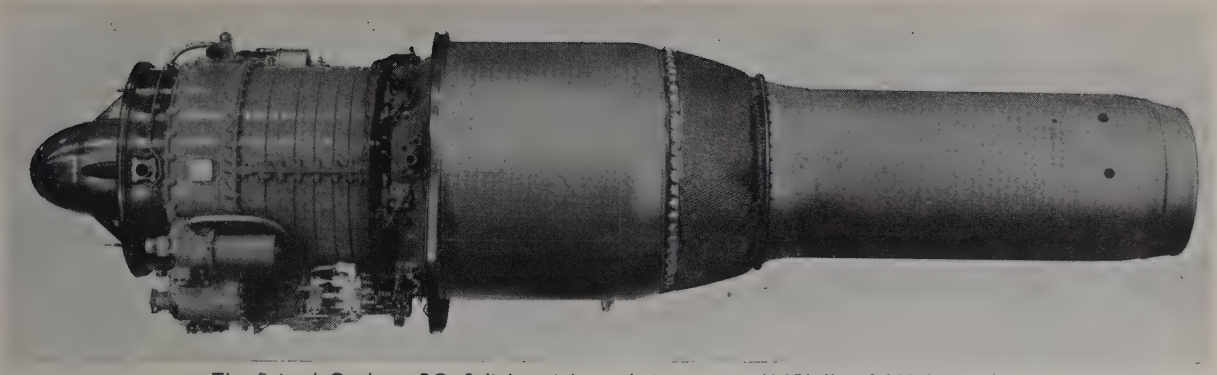
H.P. COMPRESSOR.—Eight-stage axial-flow type. Forged DTD.282 high-chrome steel rotor blades attached by "fir tree" roots to the S.96 steel rotor discs which are mounted between an S.96 front end disc and S.62 rear end disc. Entry guide vanes and two rows of outlet guide vanes are forged from DTD282. Stator blades are of DTD.171 heat-resistant stainless steel. Casing in two sections, of Firth-Vickers FCB heat-resistant steel. Shaft carried on front roller bearing and rear ball bearing.

DELIVERY CASING.—Inner and outer casings of Firth-Vickers FCB heat-resistant steel joined by ten radial struts to form very rigid structure.

COMBUSTION CHAMBER.—"Cannular" type, with DTD.171 stainless steel inner and outer casings containing ten Nimonic 75 flame tubes. Downstream fuel atomising injectors. High-tension plugs in two of lower flame tubes on early engines. High-energy plugs on Mk. 101 engines.



The Bristol Olympus BOl.6 turbojet engine, four of which will power the Avro Vulcan B. Mk. 2 bomber.



The Bristol Orpheus BOr.3 lightweight turbojet engine (4,850 lb.=2,200 kg. s.t.).

FUEL SYSTEM.—Low-pressure type. Two Lucas C-size variable-stroke plunger pumps, full-range flow control unit and flow distributor. Ten Duplex 3 fuel injectors. (Mk. 101 has single D-size pump).

L.P. NOZZLE GUIDE VANES.—Two-stage, with Nimonic 80 precision cast vanes.

L.P. TURBINE.—Single-stage with Nimonic 80A blades with shrouded tips, mounted by "fir tree" roots on drop-forged Firth-Vickers 448 (or Jessop's H.46) ferritic steel disc. Disc spigoted and through-bolted to S.106 steel shaft.

H.P. TURBINE.—Single-stage with similar construction to L.P. Turbine.

JET PIPE.—Fixed type. Firth-Vickers FDP stainless steel jet pipe and DTD.171 stainless steel exhaust cone.

ACCESSORY DRIVE.—On the BOl.1 auxiliary drive shafts were taken out through radial struts in the intermediate and delivery casings. From the BOl.1/2B on all accessory gear trains have been in the intermediate casing.

LUBRICATION SYSTEM.—Closed system. Main pressure pump feeds bearings through calibrated orifices. Gravity drainage to sumps under intermediate and delivery casings; scavenge pump feed back to main oil tank.

MOUNTING. — Four-point suspension, with trunnions on each side of L.P. compressor casing and on each side of delivery casing.

STARTING.—Electric starter on starboard upper side of delivery casing on BOl.1; on port side of intermediate casing on BOl.1/2C.

DIMENSIONS (Olympus 101).—
Max. diameter 40.9 in. (1,039 mm.).
Length overall 167.0 in. (4,242 mm.).

DIMENSIONS (Olympus 102 and 104).—
Max. diameter 42.4 in. (1,077 mm.).
Length overall 171.0 in. (4,343 mm.).

DIMENSIONS (Olympus 200).—
Max. diameter 41.75 in. (1,060 mm.).
Length overall 126.4 in. (3,210 mm.).

WEIGHT (Olympus 101).—
3,650 lb. (1,657 kg.).

PERFORMANCE (Olympus 101).—
Max. thrust 11,000 lb. (4,990 kg.).
Cruising thrust 8,000 lb. (3,630 kg.).

PERFORMANCE (Olympus 102).—
Max. thrust 12,000 lb. (5,443 kg.).

PERFORMANCE (Olympus 104).—
Max. thrust 13,000 lb. (5,897 kg.).

PERFORMANCE (Olympus 200).—
Max. thrust 16,000 lb. (7,260 kg.).

FUEL CONSUMPTION (Olympus 101).—
At max power 0.79 lb./lb. thrust/hr. (0.79 kg./kg. thrust/hr.).
At cruising power 0.75 lb./lb. thrust/hr. (0.75 kg./kg. thrust/hr.).

THE BRISTOL ZEPHYR.

The Zephyr turbojet has been developed from the Olympus for civil use jointly by Bristol and the American Curtiss-Wright Corporation. Details are given under "Wright" in the U.S. section of this work.

THE BRISTOL ORPHEUS.

The Orpheus is a single-spool turbojet engine which was initiated in 1953 by the Bristol company as a private venture, to meet the requirement for an engine in the medium thrust range for applications where low weight and small frontal area are of prime importance.

The Orpheus is reported to have a seven-stage compressor, annular combustion chamber with separate flame tubes and single-stage turbine. Acceleration from idling to maximum power is said to be possible in under four seconds without stalling or surge.

The BOr.1 version of the Orpheus, which first ran on December 17, 1954, successfully completed a 150-hour type test in the Spring of 1955, at an initial rating of 3,285 lb. (1,490 kg.) equivalent to 4.4 lb. thrust per lb. of engine weight. It was first flown in the prototype Folland Gnat Mk. 1, on July 18, 1955.

The rapidity of the design and manufacture of the first engines has been matched by the speed with which the Orpheus has been developed to higher ratings, and the following versions have been announced :—

BOr.1. Now rated at 4,050 lb. (1,837 kg.) s.t., following type test at this figure in January, 1956. Flown in prototype Fiat G.91 and Dassault Etendard VI, as well as Folland Gnat.

BOr.2. Type-tested in November, 1956 at rating of 4,520 lb. (2,050 kg.) and with improved altitude performance. Intended primarily for Folland Gnat.

BOr.3. Rated at 4,850 lb. (2,200 kg.) s.t. Almost identical with BOr.2 except for accessories. Current production version. Specified for the Fiat G.91, Dassault Etendard VI and Breguet 1001 Taon.

BOr.4. Similar to BOr.3. De-rated to 4,230 lb. (1,919 kg.) s.t. Intended for use in transport and training aircraft.

BOr.11. Development of BOr.3. Rating increased to 5,760 lb. (2,613 kg.) s.t. for very small increase in weight. Announced in March, 1957.

BOr.12. Further development of BOr.3 for NATO light fighters. Rated at 6,810 lb. (3,089 kg.) s.t., or 8,000 lb. (3,628 kg.) s.t. with reheat.

In addition to the types of aircraft mentioned above, the Orpheus has been specified for the Aerfer Leone and Hispano HA-300 fighters, the Fuji T1F1 trainer and other advanced projects.

The Orpheus is being developed under Ministry of Supply contract in connection with the joint Mutual Weapons Development Programme agreement between the United States and the United Kingdom. It is the only engine selected for development under this programme with the aid of U.S. funds.

The Orpheus will also be manufactured under licence at Bangalore, India, to power Indian-built Folland Gnats. An option to build it is held by the Fiat company in Italy.

DIMENSIONS (BOr. 1 and 2).—
Diameter 32.4 in. (823 mm.).
Overall length 90.25 in. (2,292 mm.).

DIMENSIONS (BOr.3 and 4).—
Diameter 32.4 in. (823 mm.).
Overall length 96.1 in. (2,441 mm.).

DIMENSIONS (BOr.11).—
Diameter 32.4 in. (823 mm.).
Overall length 99.9 in. (2,538 mm.).

WEIGHT (BOr.2).—
790 lb. (358 kg.).

WEIGHT (BOr.3).—
810 lb. (367 kg.).

CONSUMPTION (BOr.3).—
At max. power 1.06 lb./lb. s.t./hr. (1.06 kg./kg. s.t./hr.).

THE BRISTOL ORION.

The Orion is a turboprop engine which has been designed specifically for transport operation. Initial bench-testing began on December 17, 1955 and 1,000 hours of development running were completed within the first year. The Orion flew for the first time in the starboard outer engine position on the prototype Britannia (G-ALBO) on August 31, 1956, and it is proposed eventually to fit four Orions in G-ANCA, the first Britannia 301.

The Orion is the first aircraft engine of a new type known as a supercharged turboprop. It is basically capable of developing about 8,000 h.p. at full throttle at sea level, but the power output is limited so that, with the present marks of engine, the maximum shaft horsepower developed under any circumstances does not exceed 4,400. In this way, it was possible to avoid having to stress the casings for higher pressures at sea level and having to provide a reduction gear and airscrew which would be unnecessarily heavy throughout the greater part of the engine's running time.

As a result, the cruising power/weight of the Orion is far in advance of that of other engines, while permitting a low turbine entry temperature to be used, which is desirable to ensure long periods between overhauls.

This concept automatically results in a constant shaft horsepower being available at all airfield elevations up to the full throttle height of the engine at each rating. For example at the take-off rating, 4,400 s.h.p. is available up to 15,000 ft. (4,570 m.) at standard temperatures. The full shaft horsepower is available from almost every aerodrome in the world, irrespective of its elevation or climatic temperature, thus permitting full-load take-off of the aircraft in which it is fitted.

As with the supercharged piston-engine, lower powers are available up to greater full-throttle heights; for example, the shaft horsepower at the climb rating is constant at 3,900 s.h.p. up to an altitude of over 20,000 ft. (6,940 m.). Owing to the reduction of the residual jet thrust, the total equivalent horsepower falls off, but the thrust forms such a small proportion of the total power that this reduction is small below the full-throttle height: for example, at the take-off rating 5,150 e.h.p. is available at sea level, and 4,925 e.h.p. is still available at 15,000 ft. (4,570 m.).

Designed from the outset as a complete power plant, the Orion is no heavier or larger than the Proteus power plant, which develops about half as much cruising power. It is a two-spool design in which the high-pressure turbine and compressor form a mechanically independent unit, supported in two bearings; while the three-stage low-pressure turbine



A Bristol Orion power plant installed in the port outer position of a Britannia flying test-bed aircraft.

drives not only the low-pressure compressor but also the airscrew through an epicyclic reduction gear.

The Orion will be fitted in later series Britannias, and will also be used in the Canadair CL-44 (CC-106) transport which has been ordered for the Royal Canadian Air Force. Two versions have been announced.

BOn.1. Initial production version.

BOn.2. Generally similar to BOn.1, with same rating, but incorporating a number of design improvements.

The following description refers specifically to the BOn.1.

TYPE.—"Constant power" two-spool axial-flow turboprop.

AIRSCREW DRIVE.—Compound epicyclic reduction gear with drive from low-pressure rotor. Ratio 0.1006 : 1.

AIR INTAKE.—Forward-facing direct-entry type.

LOW-PRESSURE COMPRESSOR.—Seven-stage axial-flow compressor comprising a series of steel discs splined to the compressor shaft. Steel blades attached to discs by "fir-tree" roots. Two-piece steel stator casing with blades retained in dovetail grooves.

HIGH-PRESSURE COMPRESSOR.—Five-stage axial-flow compressor of steel construction, similar to that of low-pressure compressor. Stator casing mounted within the engine mounting casing, being secured to it at the rear end. An annular space is thus formed between the casings from which air tapped off in front of the compressor inlet may be delivered to aircraft services.

COMBUSTION EQUIPMENT.—Tubo-annular or "cannular" type. Ten Nimonic 75 flame tubes, each fed by a single Simplex burner supplied from a shrouded fuel gallery.

NOZZLE GUIDE VANES.—The four stages of turbine stators are mounted so as to be free for thermal expansion while preserving concentricity. Nimonic 90 for the first stage, Nimonic 80 for the second and third stages, and Jessops G-18B for the fourth stage.

TURBINE.—Single-stage axial-flow high-pressure turbine, followed by three-stage axial-flow low-pressure turbine. High-pressure turbine drives the high-pressure compressor, the rotating assembly having two bearings. Low-pressure turbine discs drive the turbine shaft through dogs, being held in abutment by a ring nut on the rear end of the shaft. Turbine shaft is connected to the rear of the low-pressure compressor shaft through a splined coupling. High-pressure turbine blades of Nimonic 90. Low-pressure rows of blades respectively Nimonic 90, Nimonic 80A, and Nimonic 80, all but the last stage being shrouded. All turbine discs of Rex 448 austenitic steel.

EXHAUST SYSTEM.—Exhaust cone supports central bullet fairing through eleven radial struts. Jet pipe varies according to installation.

FUEL SYSTEM.—Lucas swashplate fuel pump, with barometric pressure control and air/fuel ratio control. Shut-off cock and torque limiter are combined in unit with B.P.C. Throttle valve operated by electric actuator.

ACCESSORY DRIVES.—Accessories, including 47 k.v.a. alternator, mounted on engine.

LUBRICATING SYSTEM.—Three independent oil systems, feeding respectively the reduction gear, low-pressure rotor and high pressure rotor, and driven from the corresponding system. Oil tank, with capacity of 11 Imp. gallons (50 litres) carried by anti-vibration mountings on starboard side of engine. No-loss oil filter. Two 10 in. (25.4 cm.) diameter oil coolers, one on each side of engine.

OIL SPECIFICATION.—DERD.2487 or DERD. 2479/1.

MOUNTING.—Four mounting fixtures at rear of high-pressure compressor. Air-cooled dynamic suspension units or rigid mountings.

STARTING.—Electric. Provision for 24 v. or 110 v. starter motor. Plessey starting pump.

DIMENSIONS.—
Max. diameter 41.8 in. (1,060 mm.).
Length (cone fitting line to exhaust flange) 112.3 in. (2,850 mm.).
Frontal area 9.5 sq. ft. (0.88 m.²).

WEIGHT.—
Dry, including oil tank, oil coolers and suspension units 3,200 lb. (1,450 kg.).

PERFORMANCE.—
Take-off power at S/L. 4,400 s.h.p. plus 1,950 lb. (884 kg.) jet thrust (=5,150 e.h.p.) at 10,000 low-pressure r.p.m.
Max. continuous power at S/L. 3,900 s.h.p. plus 1,410 lb. (640 kg.) jet thrust (=4,440 e.h.p.) at 8,860 low-pressure r.p.m.
Max. recommended cruise power at 30,000 ft. (9,140 m.) and 400 m.p.h. (650 km.h.) 3,460 s.h.p. plus 390 lb. (177 kg.) jet thrust (=3,960 e.h.p.) at 8,860 low-pressure r.p.m.

CONSUMPTIONS.—
Specific fuel consumption at take-off rating at S/L. 0.64 lb. (0.29 kg.) per e.h.p./hr.
Specific fuel consumption at 30,000 ft. (9,140 m.) at 400 m.p.h. (650 km.h.) 0.41 lb. (0.18 kg.) per e.h.p./hr.
Oil consumption (max.) 2 Imp. pints (1.13 litres) per hour.

THE BRISTOL PROTEUS 750 SERIES.

This is the first development derivative of the Proteus 700 Series.

The Proteus 755 of this series is in production for the Britannia Series 250, 300 and 310. It is externally very similar to the Proteus 705, but can be distinguished by the fact that the drive below the reduction gear carries a 47 kva alternator, as compared to the shaft drive to a remote accessory gearbox on the earlier engine.

DIMENSIONS.—
Overall diameter 40.1 in. (1,041 mm.).
Overall length 113.25 in. (2,870 mm.).

DRY WEIGHT (including turbine bleed manifold for airframe de-icing, but less exhaust cone) 2,900 lb. (1,315 kg.).

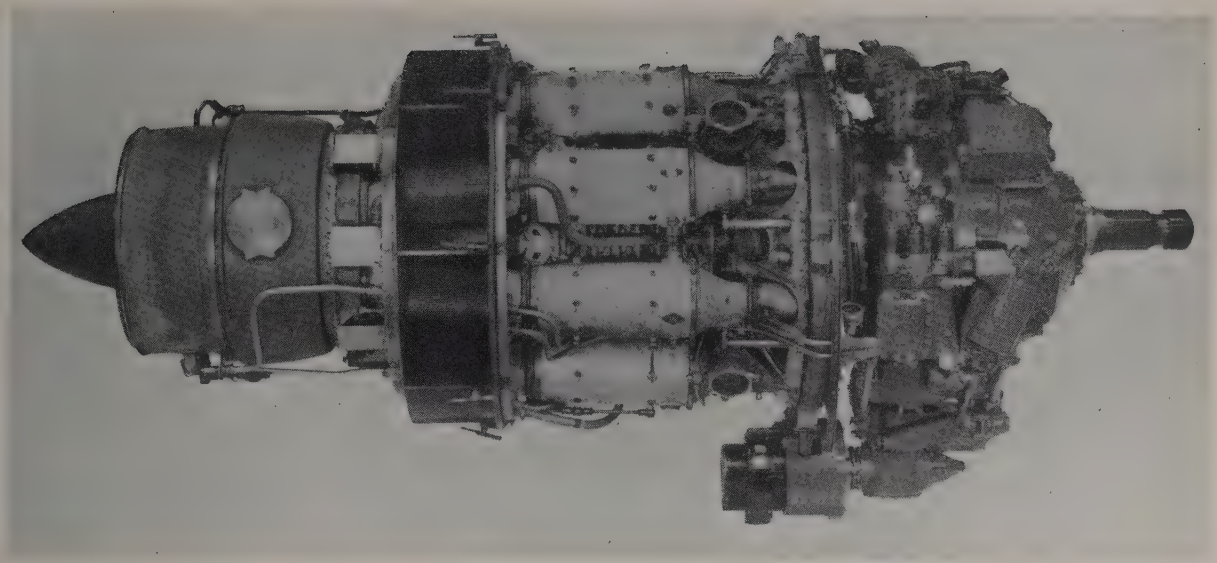
PERFORMANCE RATINGS.—
Take-off (static) 3,650 s.h.p. plus 1,220 lb. (558 kg.) jet thrust (=4120 e.h.p.).
Max. continuous power (static) 3,360 s.h.p. plus 1,120 lb. (508 kg.) jet thrust (=3,790 e.h.p.).
Max. continuous power at 345 m.p.h. (555 km.h.) at 30,000 ft. (9,140 m.) 1,700 s.h.p. plus 350 lb. (159 kg.) jet thrust (=2,100 e.h.p.).

CONSUMPTIONS.—
Fuel at max. power 0.60 lb. (0.27 kg.) per s.h.p./hr.
Fuel, at max. continuous power at 30,000 ft. (9,140 m.) 0.480 lb. (0.218 kg.) per e.h.p./hr.

THE BRISTOL PROTEUS 700 SERIES.

The first production version of the Proteus is designated the 700 Series. This series includes the Mk. 705, which powers the Britannia Series 100 airliners in service with B.O.A.C., and follows the earlier 600 Series in general layout, but is completely new in detail. In particular, the compressor and turbine designs take advantage of recent advances in aerodynamics.

The general arrangement of the engine is such that air enters the compressor through a casing to the rear of the combustion chambers, passing forward through the axial section of the compressor to the final centrifugal stage. In the diffuser of the centrifugal stage the air is turned rearwards to enter the combustion chambers, which surround the centrifugal portion of the compressor. The hot gas then passes through "tunnels"



The Bristol Proteus 755 turboprop engine (3,650 s.h.p. plus 1,220 lb.=558 kg. jet thrust).

in the above-mentioned casing to the two-stage compressor-driving turbine, which is immediately followed by the two-stage power turbine. After passing through the power turbine the hot gas is exhausted rearwards through the jet pipe.

The power turbine is mechanically independent of the compressor-driving turbine, and drives a two-stage epicyclic reduction gear through a shaft which runs coaxially within the shaft carrying the compressor and its associated turbine. The airscrew shaft forms a unit with the planet carrier of the reduction gear, while the annulus gear has associated with it a hydraulic torquemeter, through which the reaction on the annulus is transmitted to the casing. A parking brake is incorporated to prevent the airscrew of a parked aircraft from being windmilled.

By May, 1957, Proteus 700 and 750 Series engines had accumulated a total running time of over 75,000 hours, including bench and flight operation, and this figure was increasing at that date by about 6,000 hours per month, including airline operation and bench and flight development. This is in addition to some 20,000 hours' development carried out on the earlier 600 series engines.

On entering airline service, the Proteus 705 engines had a permitted life between overhauls of 500 hours. Within a month the overhaul life had been extended to 650 hours, and stood at 1,050 hours at the time of writing.

The following description and specification refer to the Proteus 705.

TYPE.—Reverse-flow turboprop engine.

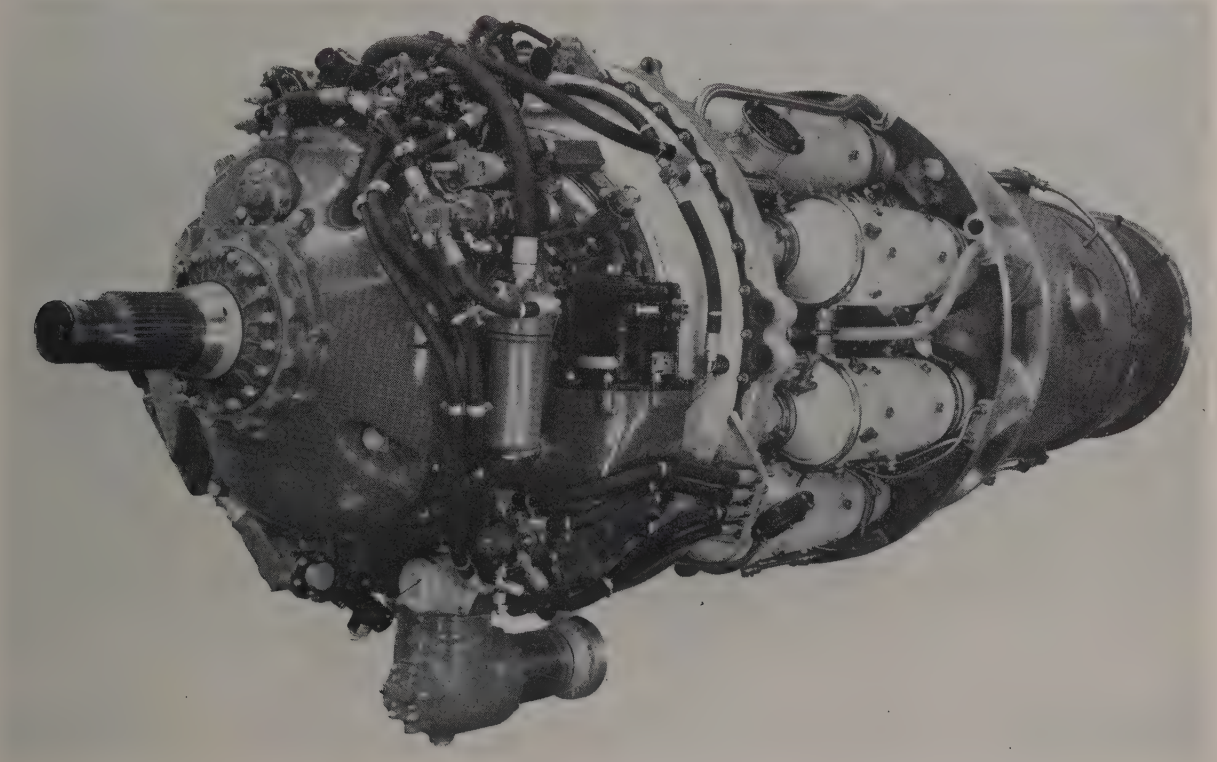
AIRSCREW DRIVE.—Compound epicyclic reduction gear with drive from free turbine. Ratios 11.111 or 0.09 : 1.

AIR INTAKE.—Radial type between compressor and turbine sections. The intake is a single light alloy casting and is a full structural member of the engine body. Provision for de-icing.

COMPRESSOR.—Twelve axial stages followed by a single centrifugal stage. Axial rotor made up of twelve discs secured by through-bolts. Rotor blades (714) secured in axial grooves of "fir-tree" section. Stator blades (644) held in circumferential grooves of "dovetail" section in light alloy two-piece casing. Single steel centrifugal impeller has 31 vanes and is flanged and bolted to shaft. Radial diffuser of high-temperature aluminium-alloy directs air to eight transfer ducts leading to combustion chambers. Compression ratio 7.2 : 1. Mass air flow 42.5 lb. (19.3 kg.) per sec.

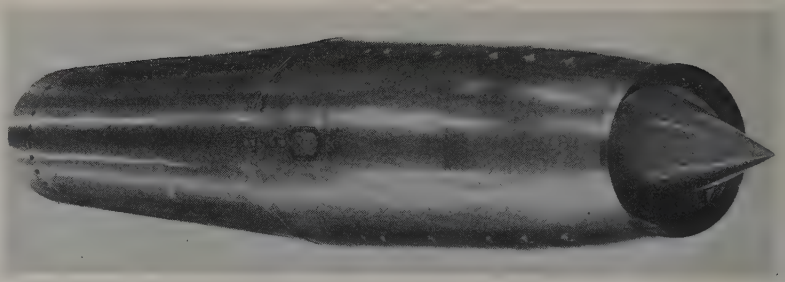
COMBUSTION CHAMBERS.—Eight tubular chambers of mild steel with concentrically mounted flame tubes of Nimonic alloy. Lucas Simplex burners with downstream injection. K.L.G. igniter plugs in primary zone of two flame tubes. Rotax H.T. booster coil.

FUEL SYSTEM.—Lucas system incorporating fuel pump, throttle valve, barometric pressure control, H.P. shut-off cock and burners. Maximum fuel pressure 1,400 lb./sq. in. (98.4 kg./cm.^{2}). Water injection available for special performance.



The Bristol Proteus 705 turboprop engine, four of which power the Britannia 102 airliner.

FUEL GRADE.—DERD 2482.
NOZZLE GUIDE VANES.—Eighty Nimonic alloy blades precision cast in segments of 3 or 7 blades.
TURBINE.—Two separate two-stage axial-flow turbines, the first driving the compressor and the second the airscrew reduction gear through bore of compressor rotor. All blades machined from Nimonic alloy and secured to stainless steel rotor discs by "fir-tree" roots. 80 blades in first stage, 70 in second, 56 in third and 64 in fourth. Gas temperatures 872°C. before turbine, 500°C. after turbine.
JET PIPE.—Fixed. Austenitic stainless steel jet pipe and inner bullet.
ACCESSORY DRIVES.—From main reduction gear below engine to auxiliary box, which has drives for all accessories, including generator.
LUBRICATION SYSTEM.—Dry sump. Bristol gear type pump and accessories. Oil tank capacity 14 Imp. gallons, including air space and feathering compartment.
OIL SPECIFICATION.—DTD.2479.
MOUNTING.—Four-point mounting with pads in plane of centrifugal impeller.
STARTING.—Electric starter on gear case. Plessey starting pump.
DIMENSIONS.—
Overall diameter 40.1 in. (1,020 mm.).
Length (from cone fitting line to jet pipe attachment face) 100.6 in. (2,540 mm.).
Frontal area 8.5 sq. ft. (0.78 m.²).
NET DRY WEIGHT.—
2,945 lb. (1,325 kg.).
PERFORMANCE RATINGS.—
Take-off (static) 3,472 s.h.p. plus 1,090 lb. (495 kg.) jet thrust (=3,900 e.h.p.) at 11,700 compressor r.p.m. at sea level.
Max. continuous power 2,990 s.h.p. plus 990 lb. (450 kg.) jet thrust (=3,370 e.h.p.) at 11,350 compressor r.p.m. at sea level.
CONSUMPTIONS.—
Fuel 0.514 lb. (0.233 kg.) per e.h.p./hr. at max. continuous power at 345 m.p.h. (552 km.h.) and 30,000 ft. (9,140 m.).
Oil (max.) 2 pints (1.13 litres) per hour.



A Bristol Thor Supersonic ramjet engine.

THE BRISTOL THOR.

The Thor BT.1 (BRJ.5/1) and 2 (BRJ.5/2) are production versions for the Ministry of Supply of the series of supersonic ramjet engines developed initially by Bristol as the BRJ-2 and 4. More than 200 test vehicles powered by these ramjets have been fired at Aberporth and Woomera since 1952, reaching high supersonic speed and altitudes beyond those at which manned aircraft are operated. As a result, the Thor is now fully developed and suitable for both guided weapon and piloted aircraft applications, with a starting reliability of 100 per cent.

Ramjets of the Thor type are in production for the Bristol/Ferranti Bloodhound surface-to-air guided missile.

Few details of the construction of the Thor are available beyond those shown in the accompanying photograph, in which the true nose cone is not shown for security reasons. The conical air intake centre-body is of the two-shock type, supported by three equi-spaced faired struts. Behind it is a series of fuel injection rods, each with two or three downstream nozzles, the fuel being ignited by strontium flares.

The standard Thor is stated to develop 90,000 thrust horse-power (about 15,000 lb.=6,800 kg. s.t.) at Mach 3 at sea level. It has an overall diameter of 15.75 in. (400 mm.) and length of approx. 100 in. (2,540 mm.). A larger, more advanced ramjet on the same lines, designated the BRJ-801, with a diameter of 18 in. (455 mm.), was shown at the 1957 S.B.A.C. Display.

THE BRISTOL RAVEN.

The Raven is a solid-propellent rocket motor, built by Bristol Aircraft Ltd. (Weston Division) in collaboration with the Royal Aircraft Establishment, Westcott. It powers the Skylark research rocket of which details are given in the "Guided Missiles" section of this work.

The Raven is 18 ft. (5.49 m.) long and gives a thrust of 11,500 lb. (5,215 kg.) for about 30 sec.

DE HAVILLAND

THE DE HAVILLAND ENGINE COMPANY, LTD.

HEAD OFFICE: LEAVESDEN, HERTFORDSHIRE.

Directors: Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S. (President); A. F. Burke, O.B.E., M.Inst.T., F.R.S.A. (Chairman); H. Buckingham (General Manager); W. E. Nixon, F.C.I.S.; J. L. P. Brodie, M.I.A.E., M.I.Mech.E.: Dr. E. S. Moult, Ph.D., B.Sc.(Eng.), M.I. Mech.E., F.R.Ae.S.; and M. G. Ash.

The de Havilland Engine Co., Ltd., which is one of the three main operating subsidiaries in Great Britain of de Havilland Holdings, Ltd., entered the jet-propulsion field in the Spring of 1941. Design of the first D.H. jet engine—the H-1 or Goblin—began in April, 1941, and within a year the prototype was running on the Hatfield test-beds. Within two months the engine was giving its designed thrust, by March 5, 1943, it was flying in a Gloster Meteor, and by September 20, 1943, it was taking the D.H.100 Vampire single-seat single-jet fighter monoplane on its initial flights.

The Goblin powers the D.H. Vampire, for which it was specifically designed.

The Ghost 50 was the first pure jet engine to obtain civil A.R.B. type-approval and was used to power the D.H. Comet 1 and 1A. The Ghost 48 is the power-unit of the D.H. Venom and Sea Venom fighters. In addition to its British production, the Ghost is being built under licence in Italy, Sweden and Switzerland.

Under development is the Gyron, de Havilland's first axial-flow turbojet engine, which will power the Hawker P.1121 fighter, and a smaller version known as the Gyron Junior, which will power the Saunders-Roe P.177 mixed power-unit interceptor.

In addition to its work on gas-turbines, the company has an establishment at Harlow engaged solely on rocket development. The Sprite introduced in 1949, was the first rocket motor for semi-permanent installation produced in the United Kingdom. It has now been superseded by the Super Sprite, which is available for use in both military or civil transport aircraft, and is being employed in the form of a jettisonable under-wing "pod" to assist the take-off of the Vickers Valiant bomber.

The later Spectre rocket powers the Saunders-Roe S-R.53 research aircraft and will also be fitted in the developed Saunders-Roe P.177 interceptor.

de Havilland have an agreement with the American General Electric company covering the exchange of technical information on all aspects of gas-turbine development.

THE DE HAVILLAND GYRON JUNIOR.

The DGJ.1 Gyron Junior, which began test-bed running in the Summer of 1955, is a smaller version of the Gyron. This engine has been developed under a Ministry of Supply contract since September, 1954.

The Gyron Junior ran for the first time in August, 1955 and was shown publicly for the first time at the 1956 S.B.A.C. Display. No details were given, but a number of features were externally evident.

The air intake is a straightforward casting, forming an integral oil tank, and is de-iced by hot air bled from the compressor delivery manifold. Variable incidence guide vanes are fitted forward of the compressor which appears to have seven stages. Thirteen burners are provided in the cannular combustion chamber and a multi-stage turbine is used.

The first 150-hour test was run in September, 1956 and 1,000 hours of bench-testing had been completed by the end of that year. Tests have included many hours of running with reheat. First flight trials were in a modified Canberra in May, 1957.

DIMENSIONS (approx.).—
Diameter 32 in. (813 mm.).
Length 88.5 in. (2,247 mm.).
PERFORMANCE RATING.—
Max. static thrust 7,000 lb. (3,180 kg.) at sea level.

THE DE HAVILLAND GYRON.

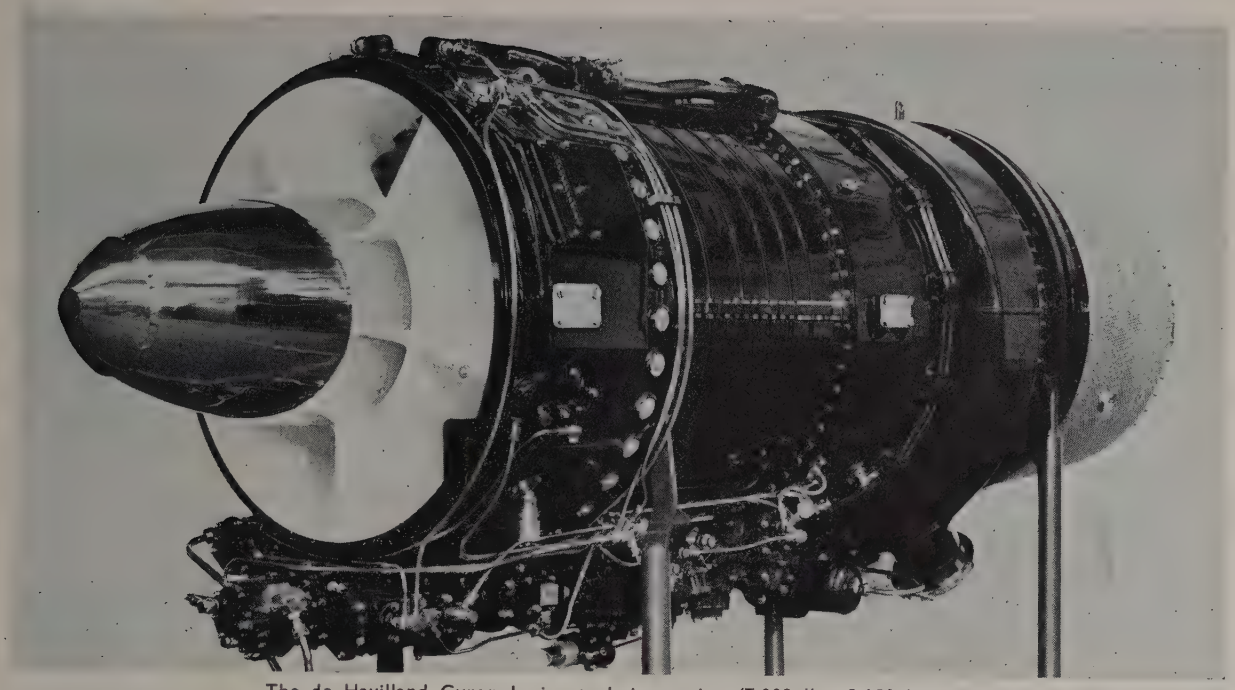
The Gyron axial-flow turbojet engine is designed specifically for flight at supersonic speeds.

Development began in 1950 and, except for a four-year period of official support, has been undertaken as a private venture.

The Gyron DGy.1 which ran for the first time on January 5, 1953, passed its 150 hour type-approval test at an initial thrust-rating of 15,000 lb. (6,810 kg.) in August, 1955. It began its air testing in the lower port engine nacelle of the Short Sperrin four-engined bomber on July 7, 1955.

On March 4, 1957, it was announced that the Gyron DGy.2 was then rated at 20,000 lb. (9,072 kg.) s.t. dry and 25,000 lb. (11,340 kg.) s.t. with reheat.

TYPE.—Axial-flow turbojet for use at high supersonic speeds.
AIR INTAKE.—Annular intake surrounding starter bullet. Both bullet and outer casing are double-walled for thermal de-icing. Air intake is a magnesium-zirconium alloy casting, the outer casing carrying the centre housing for the front main bearing *via* seven radial struts. In rear of intake casing are the hydraulically-operated variable-incidence compressor inlet guide vanes with actuator ring in rear face of centre housing.
COMPRESSOR.—Seven-stage axial type. Constant-diameter single-wall casing is split transversely and longitudinally, front pair of casings being machined from castings in R.R.58 aluminium-alloy and rear pair from castings in Samuel Fox Fortiweld high-tensile welding steel. Stator blades, machined from forgings in S.62 stainless steel, carried in dovetail grooves machined in casing. Rotating compressor assembly, using S.97 high tensile alloy steel throughout, consists of thin discs to carry the compressor blades and drums to join the adjacent discs. Blades, of S.62 stainless steel, secured to the discs by single gudgeon-pin-type swivel fittings which allow limited degree of tip rock in plane of rotation. First-stage rotor disc has integral stub



The de Havilland Gyron Junior turbojet engine (7,000 lb.=3,180 kg. s.t.).

shaft which runs in triple-race ball-bearing in rear of intake casing. Seventh-stage disc joined at its periphery to an eighth disc which carries the compressor rotor air seal and is attached to front periphery of main turbine shaft.

Combustion Chamber.—Forward entry duct, fabricated of Fortiweld steel, comprises two concentric drums which form the diffuser outlet from compressor into the annular chamber, which contains a swirler plate assembly and inner and outer flame tubes of Nimonic 75. Seventeen Lucas Duplex burners with upstream injection.

Fuel System.—Complete system supplied by Joseph Lucas (Gas Turbine Equipment) Ltd. Comprises two multi-plunger variable-delivery pumps, a proportional-flow control unit and flow distributor. Two high-energy igniter plugs.

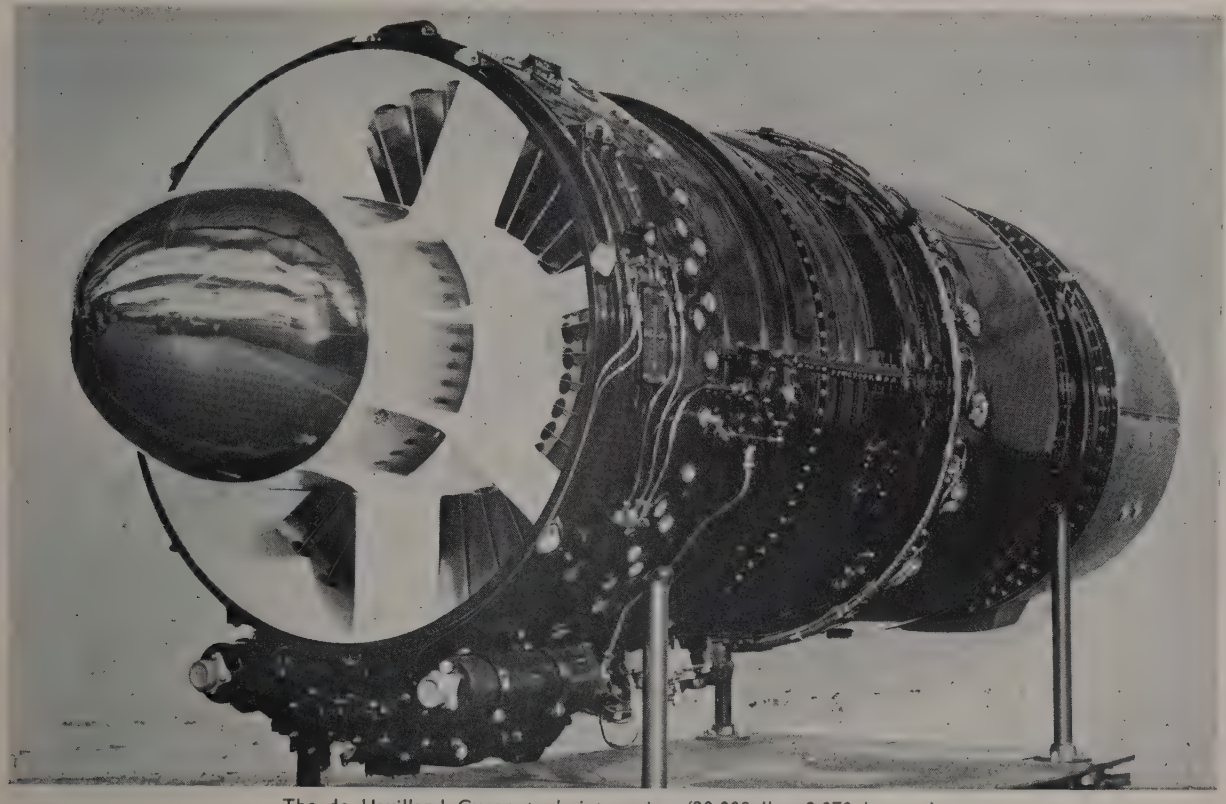
Nozzle Guide Vanes.—Two stages of nozzle blades in inner and outer shroud rings. First-stage has hollow nozzle blades, formed of Nimonic 90 sheet seam-welded along trailing-edges, which fit into profiled slots in shroud rings and are secured by tie-rods. Second stage nozzle blades are machined from Nimonic 80A forgings and are pin-mounted through end tangs in inner and outer shroud rings. Air bled from compressor is fed through hollow first-stage nozzle blades to cool all nozzle and turbine blades.

Turbine.—Two-stage. First stage disc located on main shaft by Hirth coupling, second stage disc is spigoted at its centre to rear of main shaft and attached to first stage by inter-stage drum with dowels. All blades, machined from Nimonic alloy forgings, retained in discs by fir-tree roots and pinned. Main shaft, which is attached at its front end to the eighth compressor disc, is supported at its rear end in a single roller main bearing on which the turbine is overhung, a series of spokes within the first stage nozzle blades providing radial support for the bearing housing.

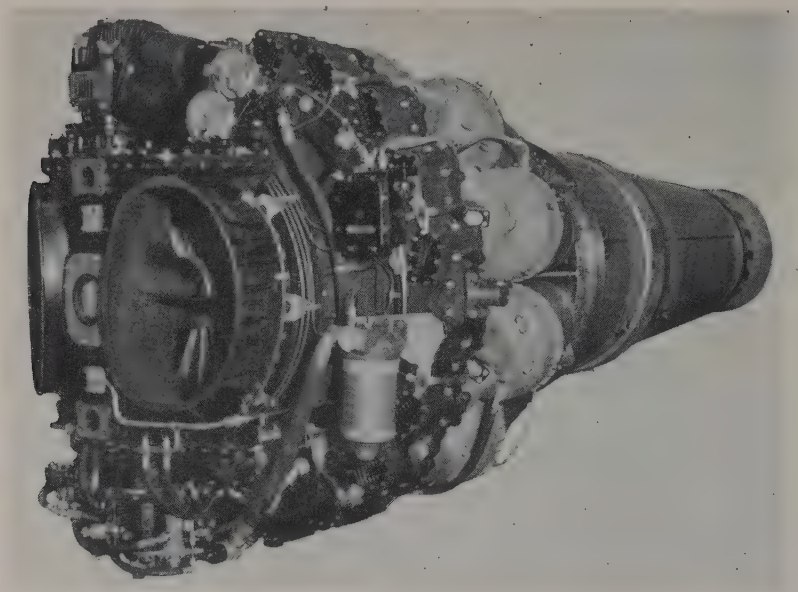
Jet Pipe.—Fixed type. Fabricated primarily in Nimonic 75 sheet.

Afterburner.—Two designs developed, one short and one long for a specific aircraft application. No details.

Accessory Drive.—Extension shaft from



The de Havilland Gyron turbojet engine (20,000 lb.=9,070 kg. s.t.).



The de Havilland Ghost 48 Mk. 1 turbojet engine.

front of compressor rotor provides drive through bevel gear-box and quill shaft to accessories mounted on underside of intake and compressor casing.

LUBRICATION.—Dry - sump type. Scavenge pump returns oil from sump to integral oil tank in annular intake casing.

OIL SPECIFICATION. DERD. 2487.

MOUNTING.—Pick-up points on intake casing and front turbine shroud ring.

STARTING.—Either a 45 h.p. Rotax 110-volt D.C. electric starter or a D.H. hydrogen-peroxide turbo starter in nose bullet.

DIMENSIONS (D.Gy.1 and 2).—
Height 55.2 in. (1,402 mm.).
Width 49.9 in. (1,268 mm.).
Basic length 121.3 in. (3,081 mm.).
Length with exhaust cone assembly and propelling nozzle 155.5 in. (3,950 mm.).

WEIGHT DRY (D.Gy.1 and 2).—
4,200 lb. (1,900 kg.).

PERFORMANCE RATING (D.Gy.1).—
Max. static thrust 15,000 lb. (6,800 kg.) at sea level.

PERFORMANCE RATING (D.Gy.2).—
Max. static thrust 20,000 lb. (9,070 kg.) at sea level.

FUEL CONSUMPTION (D.Gy.1).—
At max. s.t. 0.95 lb./lb. s.t./hr. (0.95 kg./kg. s.t./hr.) at sea level.

FUEL CONSUMPTION (D.Gy.2).—
At max. s.t. 1.04 lb./lb. s.t./hr. (1.04 kg./kg. s.t./hr.) at sea level.

THE DE HAVILLAND GHOST.

Although larger than the Goblin, the Ghost has the same basic features and simple layout of the lower-powered engine, including a single-sided impeller, a single rigid rotor assembly, straight-through combustion, single-stage turbine and cantilever mounting.

The Ghost 48 is at present available in two forms, the Marks 1 and 2, differing mainly in the fuel systems and in the fact that the Mk. 2 has provision for two generators with a correspondingly larger output. A later variant known as the Ghost 53 Mk. 1 is in production.

TYPE.—Centrifugal-flow turbojet with single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor with forged RR.58 aluminium-alloy single-sided 19-vane impeller attached to shaft by stud and dowel. Magnesium-alloy (ZRE) casing and two-piece magnesium-alloy diffuser with 20 tangential outlets. Rotative assembly runs on one ball and one roller (rear) bearing. Compression ratio (48 Mk. 1 and 2) 4.5 : 1. Compression ratio (53 Mk. 1) 4.7 : 1. Air mass flow (48 Mk. 1 and 2) 88 lb. (40 kg.) per sec. at 10,250 r.p.m. at sea level. Air mass flow (53 Mk. 1) 88.5 lb. (40.2 kg.) per sec. at 10,350 r.p.m. at sea level.

COMBUSTION CHAMBERS.—Ten straight-flow chambers of S84 steel each containing a concentrically-mounted perforated flame tube of Nimonic 75. Lucas Duplex II continuous-spray fuel injection nozzle in front end of flame tube. Around each nozzle is a small perforated shroud admitting 30% of the air flow for primary combustion. Remainder of air passes around front end of flame tube and enters it through the perforations. BTH or Rotax high-energy ignition.

FUEL SYSTEM (48 Mk. 1).—Lucas twin-pump system. Two multi-plunger variable-stroke fuel pumps with overspeed governors and relief valves. Lucas baro-metric pressure control, throttle valve, shut-off cock, low and high-pressure fuel filters and Lucas burners are fitted.

FUEL SYSTEM (48 Mk. 2).—Dowty spill flow system. Positive-displacement supply pump with overspeed governor and by-pass valve, and positive-displacement multi-plunger re-circulating pump and valve group unit. Dowty flow control and air/fuel ratio control, low-pressure fuel filter and Dowty spill flow burners.

FUEL SYSTEM (53 Mk. 1).—Lucas single fuel pump with electric maximum r.p.m. control consisting of amplifier, altitide compensating unit, servo throttle and electrical pressure control. Otherwise as 48 Mk. 1. Maximum fuel pressure 1,450 lb./sq. in. (101.9 kg./cm.²).

FUEL.—Normal kerosene and gasoline turbine fuels.

TURBINE.—Single-stage turbine. Turbine disc of Rex 448 alloy steel has 97 inserted solid blades of Nimonic 90 (48 Mk. 1 and 2) or Nimonic 100 (53 Mk. 1). Both sides of disc cooled by air tapped from compressor. Air-cooled stator blades on Ghost 53 Mk. 1 engines. Cast steel shroud has 70 inserted nozzle guide vanes of Nimonic 80 on 48 Mk. 1 and of Stellite 7 (air-cooled) on 53 Mk. 1. Gas temperatures (53 Mk. 1) 1,213°K before turbine, 1,033°K after turbine.

JET PIPE.—Steel outer casing and fixed inner cone. Sheet steel insulating shroud with air space between it and outer casing.

LUBRICATION —Front bearing lubricated direct from main pump. Rear bearing pressure-lubricated by Tecalemit micro-pump. Oil capacity 18 Imp. pints (10.23 litres). Normal oil supply pressure 25 lb. /sq. in. (1.76 kg./cm.²).

OIL.—DERD 2479/0, 2479/1 or 2487.

MOUNTING.—Four pads on diffuser front casing and two on air intake.

STARTING.—Rotax turbo starter.

DIMENSIONS.—
Max. diameter 53 in. (1,346 mm.).
Overall length to rear flange of exhaust cone 116 in. (2,946 mm.), standard exhaust cone being 51 in. (1,295 mm.) long to which is added 15 in. (38.1 cm.). for the propelling nozzle and cuff.

NET DRY WEIGHT (48 Mk. 1).—
2,145 lb. (973 kg.) ± 1¼%.

NET DRY WEIGHT (48 Mk. 2).—
2,230 lb. (1,011 kg.) ± 1¼%.

NET DRY WEIGHT (53 Mk. 1).—
2,179 lb. (988 kg.) ± 1¼%.

RATING (48 Mk. 1 and 2).—
Max. static thrust 4,850 lb. (2,200 kg.) at 10,250 r.p.m.

RATING (53 Mk. 1).—
Max. static thrust 5,300 lb. (2,405 kg.) at 10,350 r.p.m.

CONSUMPTION (48 Mk. 1 and 2 at max. static thrust).—
1.21 lb./lb. thrust/hr. (1.21 kg./kg. thrust/hr.) at sea level.

CONSUMPTIONS (53 Mk. 1 at max. static thrust).—
Fuel 1.19 lb./lb. thrust/hr. (1.19 kg./kg. thrust/hr.).
Oil 2.5 Imp. quarts/hr. (max.) (2.84 litres/hr.).

THE DE HAVILLAND GOBLIN 35.

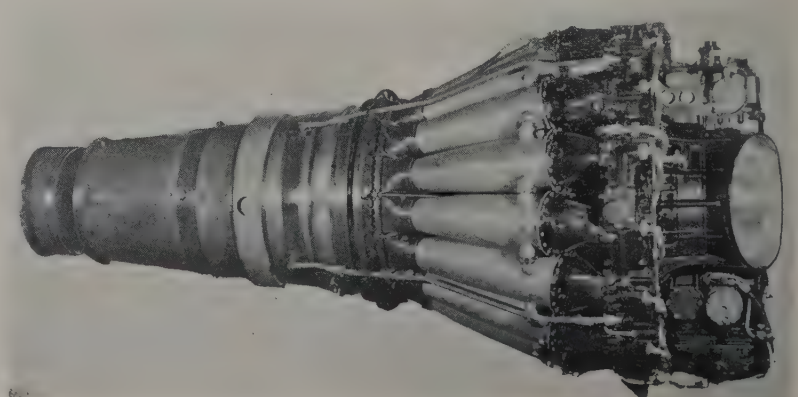
TYPE.—Centrifugal-flow turbojet with single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor with single-sided impeller. Compression ratio 3.67 : 1. Impeller fabricated from heat-treated aluminium-alloy stamping, has 17 vanes and is 31 in. (78.74 cm.) in diameter. Pivot shaft is shrunk in and bolted to front face of impeller and carries bevel gear which drives accessory shaft. Rotative assembly runs in two ball-bearings, the rear in a sliding housing to allow for rearward expansion. Bearings lubricated by metered oil flow from two metering pumps driven by accessory shaft. Rear bearing is air-cooled by air bled from diffuser.

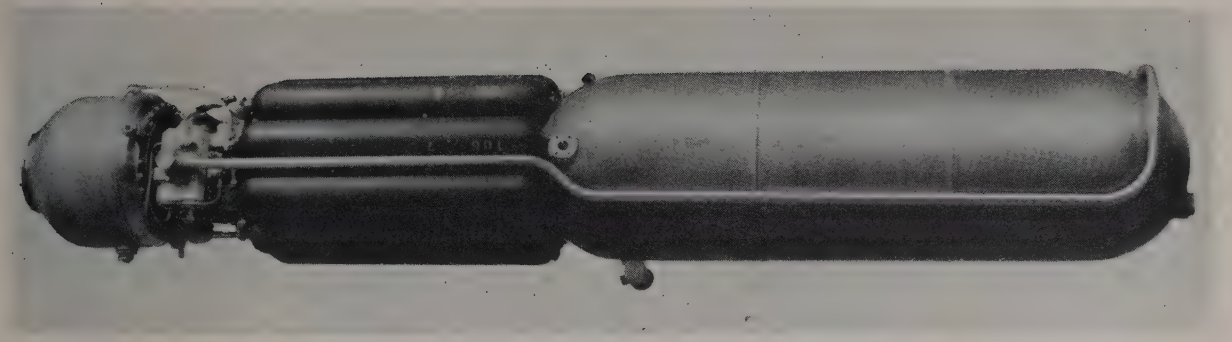
COMPRESSOR HOUSING.—In three sections. Front section of aluminium-alloy is a ribbed unit forming the two entry orifices and carries front bearing of rotor assembly and all accessories with their bevel-drive gears. Other two sections in magnesium-alloy bolted together to form diffuser, incorporating cascade guide vanes to smooth flow through right angle to combustion heads. Conical steel casing forms main lengthwise member of engine structure. Small end of centre cone is fixed to rear bearing housing just in front of turbine disc.

COMBUSTION CHAMBERS.—Sixteen straight-flow chambers with upstream ends bolted to rear face of diffuser chamber and downstream ends a sliding fit, with piston ring type seals, in turbine nozzle junction-box assembly. Combustion chamber outer casing in two parts, front half being an aluminium-alloy die casting and rear half a mild steel deep drawing. Flame-tube in two parts fabricated from 20 s.w.g. Nimonic 75.

FUEL SYSTEM.—Fuel is fed from aircraft fuel-system by immersed pump to engine rotary type fuel pump. Pump is rated at 585 Imp. gallons (2,657 litres) per hour at 1,000 lb./sq.in. (70.3 kg./cm.²) at 3,500 r.p.m.-10,500 r.p.m. engine speed. From



The de Havilland Goblin 35 turbojet engine.



The de Havilland Super Sprite Liquid-propellent Rocket motor.

pump, fuel passes through fuel control containing metering orifice, area of which is controlled by a metering needle which is so calibrated that equal movements of pilot's throttle will give equal increments of thrust. From fuel control box fuel passes to a barometric pressure control, a fuel accumulator, and automatic starting valve and into burner supply ring. 16 burners, of fixed orifice type, are inserted into combustion chambers through bosses cast in diffuser casing and are connected by flexible pipes to fuel supply ring.

FUEL.—Normal kerosene and gasoline turbine fuels.

TURBINE.—Single-stage turbine. Turbine disc of special D.12 steel with 83 blades of Nimonic 80A mechanically attached in serrated slots broached in periphery of disc. Turbine ring separated from main casing by cylindrical sheet metal skirt which connects nozzle ring at its inner periphery with conical centre casing about half-way along its length, and by diaphragm plate which connects nozzle with rear bearing housing which in conjunction with reflector plate, shields rear bearing from high turbine temperatures. Nozzle blades are drop stampings in Nimonic 80.

JET PIPE.—Sheet steel exhaust cone bolted to turbine shroud-ring tapers to an orifice 16⅜ in. (41.6 cm.) in diameter. Within jet pipe is an inner cone of sheet steel supported by two pairs of radial streamlined stays. Two of front stays are used to transmit air from diffuser casing to rear of turbine disc. Annular heater-muffs for warming aircraft cabins, guns and, in case of arctic operation, oil sump in front of engine, are welded on to outside of jet pipe. Pipe is finally enclosed in cowling through which air for cooling and insulating is drawn rearwards by suction of jet itself. Jet-pipe temperatures 710°C. maximum, 610°C. maximum continuous.

LUBRICATION.—Oil sump of about 12 pints (6.825 litres) capacity, bolted on to bottom accessory-drive gear-box on front casing. Gear-type pressure pump delivers oil to accessories and their drives and two metering pumps attached to and fed by pressure pump, feed the two bearings of rotor assembly. Oil from compressor end-bearing returns to sump while that from turbine end is drained to waste at a common drain box. Normal oil pressure at cruising r.p.m. is 35-45 lb./sq. in. (2.45-3.2 kg./cm.^{2}) at 8,700 r.p.m. Maximum oil consumption 2 pts./hr.

STARTING.—Interconnected fuel and ignition system by which rotor is slowly spun up to a speed where sufficient air flows through to ensure ignition when fuel is admitted. When this stage is reached automatic starting valve allows fuel to be injected into burners from fuel accumulator. Igniter-plugs in two combustion chambers are automatically energised. Interconnecting elbows between all chambers ensure propagation of flame round engine and serve as pressure equalisers during normal running.

DIMENSIONS.—
Max. diameter 49.85 in. (1,267 mm.).
Installed diameter (Vampire) 54 in. (1,370 mm.).
Length to rear flange of standard exhaust cone 100.5 in. (2,550 mm.).

NET DRY WEIGHT.—
1,629 lb. (739.5 kg.) + 2½%.

RATINGS.—
Max. static thrust 3,500 lb. (1,589 kg.) at 10,750 r.p.m.
Max. continuous 3,000 lb. (1,363 kg.) at 10,250 r.p.m.
Economical cruising 2,320 lb. (1,043 kg.) at 9,500 r.p.m.
Idling 155 lb. (70 kg.) at 3,000 r.p.m.

CONSUMPTION.—
Sea level static at 10,750 r.p.m. 1.16 lb./lb./hr. (1.16 kg./kg./hr.) at 9,500 r.p.m. 1.20 lb./lb./hr. (1.20 kg./kg./hr.).

THE DE HAVILLAND SUPER SPRITE.

The Super Sprite is a development of the earlier Sprite and is a liquid fuel assisted take-off rocket motor which is intended for either permanent or jettisonable installation on military or transport aircraft. The Super Sprite employs hydrogen peroxide as the oxidant with kerosene or petrol injection to boost the rocket thrust either in magnitude or duration. A solid catalyst breaks down the hydrogen peroxide into gaseous steam and oxygen; this ensures a smokeless exhaust.

The Super Sprite produces a total impulse of 120,000 lb./sec. (54,430 kg./sec.) normally with a maximum thrust of 4,200 lb. (1,905 kg.) and a duration of 40 seconds, but both the maximum thrust and total duration can be altered within certain limits to suit different installations. Unlike rockets using solid propellents the Super Sprite can be shut down at any time during the firing by simply turning off a switch.

The propellents are contained in two separate tanks, the hydrogen peroxide of 80-85% concentration in a 57 gallon (259 litre) stainless steel tank situated in front of the motor, and the kerosene or wide-cut gasoline in a 5 gallon (23 litre) tank surrounding the propelling nozzle. The propellents are transferred to the combustion chamber by the pressure of nitrogen gas which is stored in nine bottles (total 3,690 cub. in.=60,470 cub. cm. capacity at 2,900-3,100 lb./sq. in.= 204-218 kg./cm.^{2}) surrounding the combustion chamber.

The cockpit controls consist only of two switches, one of which is a safety switch which prevents the accidental operation of the unit. Until both switches are closed the motor cannot be started.

Because the Super Sprite is self-contained, a jettisonable nacelle capable of being dropped from an aircraft, recovered and, after a minimum of servicing, re-installed for the next take-off, has been developed. Its overall dimensions are approximately 150 in. long × 32 in. high × 28 in. wide (380 × 80 × 70 cm.) and its fuelled weight is about 1,900 lb. (860 kg.).

The nacelle is equipped with a parachute and parachute release-gear for the descent and a self-inflatable air-bag to cushion the impact of the nacelle with the ground. The parachute gear has been designed to give a rate of descent of 25 ft./sec. (7.6 m./sec.). The nacelle can be released from as low as 1,000 ft. (305 m.) and at speeds of up to 290 m.p.h. (465 km.h.).

First use of this Super Sprite jettisonable nacelle is to assist the take-off of the Vickers Valiant bomber.

The Super Sprite was the first British rocket engine to receive official type approval for quantity production and general service use.

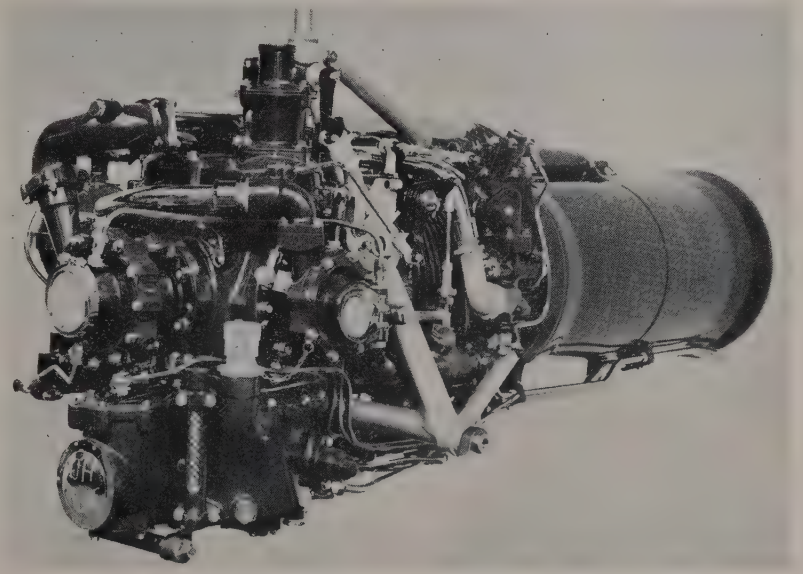
DIMENSIONS.—
Overall diameter 20.5 in. (51.4 cm.).
Overall length 117.25 in. (297.8 cm.).

WEIGHTS.—
Dry 620 lb. (281.2 kg.).
Fuelled 1,460 lb. (662.2 kg.).

PERFORMANCE.—
Max. thrust 4,200 lb. (1,095 kg.).
Duration at max. thrust 40 sec.

THE DE HAVILLAND SPECTRE.

The Spectre is a liquid-propellent rocket motor which has been specifically designed for installation as part of the power-plant of interceptor fighters to enable them to achieve outstanding rate of climb and very high supersonic speeds,



The de Havilland Spectre Liquid-propellent Rocket motor.

plus the ability to accelerate and manoeuvre at altitudes well above the limits set by the conventional air-breathing jet engine.

It is of the single-chamber type, providing a continuously-variable thrust output, and incorporates all pumps, valves and controls in one compact and light assembly suitable for ready installation in aircraft. The main cylindrical structure of the engine contains the turbine for driving the propellent pumps, the catalyst chamber and the combustion chamber. Ahead of this integral assembly is the gearbox, on which are mounted the centrifugal-type propellent pumps. The various control valves and associated linkage systems are located on the port side. Under the gearbox is the oil sump, and on the starboard side are the starter unit and fuel-cooled oil cooler. All the major components, valves and control units of the engine are of de Havilland design and manufacture.

The Spectre is designed to run on kerosene fuel, with high test peroxide (H.T.P.) as the oxidant. A small high-speed turbine, energized by a separate supply of H.T.P., is employed for driving the propellent pumps and the associated decomposition products from this unit are subsequently directed through the main combustion chamber.

An important aspect of the functioning of the Spectre, is that the temperatures produced by chemically-correct combustion of an H.T.P.-kerosene mixture are as high as may be regarded practicable at present for use in long-life aircraft rocket engines. Thus the propellent combination provides the unique advantage that combustion at other than correct mixture ratios results in lower, rather than higher, gas temperatures. With imperfect mixing this implies the incurrence of "cold" spots on the combustion chamber wall as opposed to hot spots. A result of this characteristic is that an additional coolant liquid does not have to be employed to reduce the temperature of the combustion gases.

In the Spectre, the mixture ratio of H.T.P. to kerosene is in the region of 9 : 1 and the high flow of H.T.P. is able to be used to cool the chamber and nozzle before it is injected into the engine. This is known as regenerative cooling.

Packs of silver-plated gauze are provided in the catalyst chamber and the oxidant is decomposed on being passed through these. The fuel is then injected into the hot gaseous products of decomposition, so that exceptionally smooth thermal ignition of an inherently safe nature occurs. An added safety feature is that, during starting and shut-down, a purge of steam cleanses the combustion chamber and obviates the possibility of a dangerous accumulation of liquids.

The following versions of the Spectre have been announced :—

DSpe. 1. Initial version. First run "cold" on H.T.P. only, with water cooling, in July, 1953 ; and "hot," using H.T.P. and kerosene, in September, 1953. Completed Acceptance Test in October, 1953 and attained design rating in July, 1954. Water cooling was then discarded and the DSpe. 1 completed a run of over one hour's continuous operation in October, 1954, using regenerative cooling.

DSpe. 2. Constant-thrust version of simplified design. Work on this version began in 1953 under government contract and the DSpe. 2 first ran in 1955. Intended for assisted take-off applications.

DSpe. 3. Development of DSpe. 1. Variable-thrust.

DSpe. 4. Development of DSpe. 2. Constant-thrust.

DSpe. 5. Development of DSpe. 1. Variable-thrust.

A Spectre is fitted in the Saunders-Roe S-R.53 research interceptor, and the engine is also being flight tested in the bomb-bay of a Canberra test-bed aircraft. It will power the Saunders-Roe P.177 interceptor.

DIMENSIONS.—
Length 56.5 in. (1,435 mm.).
Max. diameter, excluding mounting, approx. 26.5 in. (673 mm.).
Max. diameter, including mounting, approx. 32.0 in. (813 mm.).

PERFORMANCE.—
No details available.

NAPIER

D. NAPIER & SON, LTD.

HEAD OFFICE : ACTON, LONDON, W.3.

WORKS : ACTON, LONDON, W.3., AND EAST LANCASHIRE ROAD, LIVERPOOL, 10.

Directors : Sir George H. Nelson (Chairman), P. Horsfall, H. G. Nelson, A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., Air Vice-Marshal Sir Conrad Collier, K.C.B., H. Sammons, C.B.E., M.I.Mech. E., F.R.Ae.S. (Managing).

When the evolution of the gas-turbine engine foreshadowed the obsolescence of the piston engine the Napier Company, which is a member of the English Electric Group of companies, embarked on a programme of gas-turbine design and development.

Current Napier gas-turbine products are the Eland turboprop and the Gazelle free-turbine helicopter engine. Each of these is scheduled to power new British rotary-wing aircraft. In addition, Napier has equipped a Convair-340 airliner with two Eland turboprops for test and demonstration purposes.

Gas-turbine research is undertaken in the company's research station at Liverpool ; subsequent design and prototype construction take place in the headquarters works at Acton ; and major production is centred in the Liverpool factory. Flight development and other work is done at Luton Airport, where Napier also conduct their rocket motor and ramjet activities.

A company named Napier Engines Inc. was formed in 1957, with headquarters in Washington, D.C., to handle the company's business interests in the U.S.A.

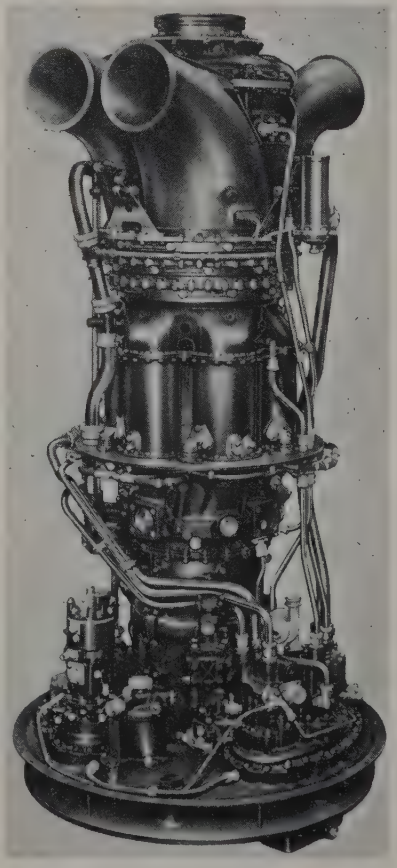
It was announced in March, 1957 that Napier and the Aerojet-General Corporation of America have concluded an agreement for the exchange of technical information on liquid-propellent rocket engines, in particular those using high test peroxide.

THE NAPIER GAZELLE.

The Gazelle is a free-turbine engine which has been designed primarily for helicopter applications and can be mounted in a horizontal, vertical or intermediate position, as required.

Design of the Gazelle began in June, 1954 and the first unit ran on December 3, 1955, developing its full specified output of 1,260 h.p. on December 14, 1955. By August, 1956, over 2,000 hours of bench-testing had been completed, including over 1,000 hours on a single engine.

Basically, the Gazelle comprises a multi-stage turbo-compressor unit, exhausting to a power-turbine which is mounted coaxially with, but mechanically independent of, the turbo-compressor unit. The final drive is taken through a reduction gearbox from the free power-turbine shaft, and the gases are exhausted to atmosphere through a bifurcated jet pipe. A torquemeter is incorporated in the reduction gearbox.



The Napier Gazelle.

An interesting feature is that the six flame tubes have a common casing. Single-lever control is provided.

At the time of writing, the Gazelle had been chosen to power the Westland Wessex and Bristol Type 192 helicopters. Prototype engines had completed successfully their 25-hour flight approval tests and one Gazelle had completed three unofficial 150-hour runs, including 150 hours at full power and 900 accelerations, without being removed from the test bed, in June, 1957.

The following development stages of the design have been announced :—

Gazelle NGa.1. Initial version with emergency rating of 1,260 s.h.p.

Gazelle NGa.2. Emergency rating of 1,650 s.h.p. Specified for Bristol Type 192 twin-engined helicopter in which they will be installed at 7° from vertical.

Gazelle NGa.3. Emergency rating of 1,800 s.h.p.

Gazelle NGa.4. Emergency rating of 2,000 s.h.p.

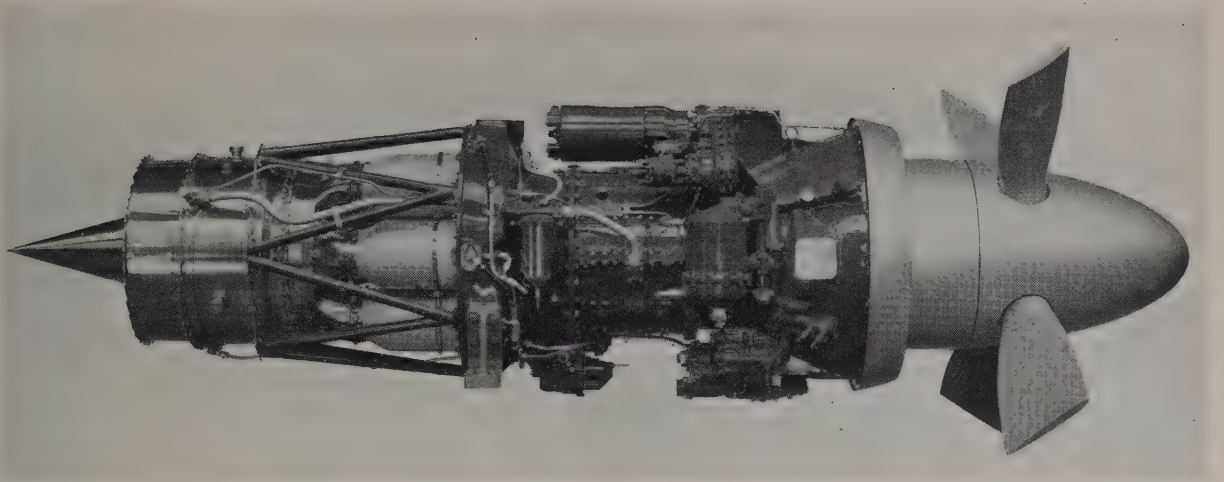
Gazelle NGa.13. One-hour rating of 1,450 s.h.p. and maximum continuous rating of 1,200 s.h.p. New power-turbine giving opposite rotation to that in other versions, for use with standard Sikorsky transmission, gearbox and rotor in Westland Wessex helicopter, in which it will be installed at 35° to horizontal.

The following structural details apply specifically to the Gazelle NGa.1 :—

TYPE.—Free turbine Helicopter engine.

AIRSCREW DRIVE.—Epicyclic reduction gear with drive from free turbine. Ball and roller bearings. Ratio 6.0 : 1.

AIR INTAKE.—Radial type R.Z.5 magnesium zirconium alloy casting consisting of two discs joined by six radial struts, at bottom of engine. Anti-icing by hot engine oil circulated through five of the struts and underside of casting, and by hot air through sixth strut. Intake carries row of hollow variable-incidence guide vanes made of thin beryllium-copper sheet, heated by



The Napier Eland N.El.1 turboprop engine (2,750 s.h.p. plus 805 lb. (365 kg.) jet thrust).

compressor-delivery air. Inlet air flow 16 lb. (7.25 kg.) per sec.

COMPRESSOR.—Eleven-stage axial-flow type at bottom of engine. Aluminium-bronze (DTD 197A) rotor blades secured by "fir-tree" roots to discs splined to shaft. Discs for stages 1, 8, 9, 10 and 11 of Rex 448 stainless steel, remainder of aluminium alloy. Shaft of S.106 stainless steel carried in roller and ball bearings. Two-piece casing cast in Z.T.1 magnesium-zirconium alloy, carrying aluminium-bronze (DTD 197A) stator blades mounted in rings bolted to casing. Compression ratio 6.37 : 1. Air mass flow 16 lb. (7.25 kg.) per sec.

COMBUSTION CHAMBERS.—Six tubular chambers made up of inner and outer flame tubes of Nimonic 75. Manufactured by Lucas. One Simplex upstream-injection burner in each chamber. Spark igniter plugs in two chambers.

FUEL SYSTEM.—Napier fuel metering unit with automatic compensation for variation in flight conditions. Lucas variable-stroke fuel pump.

FUEL GRADE.—DERD.2482, 2486 or 2488.

NOZZLE GUIDE VANES.—One row of fixed guide vanes of X.40 steel alloy for each turbine stage.

TURBINE.—Two independent axial turbines. Two-stage turbine drives compressor; single-stage turbine drives airscrew reduction gear mounted above it. Blades of compressor-turbine successively of Nimonic 100 and Nimonic 90. Blades of power-turbine of Nimonic 90. All blades attached by "fir-tree" roots to discs of Rex 448 stainless steel. Compressor-turbine discs splined to shaft of S.106 stainless steel. Power-turbine disc integral with extension shaft. Shafts carried in ball and roller bearings.

JET PIPE.—Fixed quadrupled jet pipes of Nimonic 75.

ACCESSORY DRIVES.—Through spur gears off lower end of compressor shaft in intake casing. Drive passes through one of radial struts to train of 13 gears on upper side of casing. Fuel pump, oil pumps, oil cooler fan, centrifugal breather and r.p.m. generator mounted above intake casing.

LUBRICATION SYSTEM.—Dry sump type, with gear-type pump. Normal oil supply pressure 80 lb./sq. in. (5.62 kg./cm.^{2}).

OIL SPECIFICATION. DERD.2487.

MOUNTING.—Pads on main support plate between compressor and combustion chambers.

STARTING.—Rotax type EXP.4940 electric starter mounted adjacent to compressor. Provision for combustion or B.T.H. iso-propyl-nitrate starter when available.

DIMENSIONS.—
Max. diameter 33½ in. (850 mm.).
Overall length 70 in. (1,780 mm.).

WEIGHT DRY (NGa.1).—
780 lb. (354 kg.).

WEIGHT DRY (NGa.2).—
830 lb. (376 kg.).

WEIGHT DRY (NGa.3).—
865 lb. (392 kg.).

WEIGHT DRY (NGa.4).—
900 lb. (408 kg.).

PERFORMANCE (NGa.1).—
Emergency rating (2½ min.) 1,260 s.h.p. at 20,400 r.p.m.
One-hour rating 1,100 s.h.p. at 19,800 r.p.m.
Max. continuous rating 920 s.h.p. at 19,000 r.p.m.

PERFORMANCE (NGa.2).—
Emergency rating (2½ min.) 1,650 s.h.p. at 20,400 r.p.m.
One-hour rating 1,300 s.h.p. at 19,400 r.p.m.
Max. continuous rating 1,050 s.h.p. at 18,600 r.p.m.

PERFORMANCE (NGa.3).—
Emergency rating (2½ min.) 1,800 s.h.p. at 20,400 r.p.m.
One-hour rating 1,450 s.h.p. at 19,500 r.p.m.
Max. continuous rating 1,200 s.h.p. at 18,800 r.p.m.

PERFORMANCE (NGa.4).—
Emergency rating (2½ min.) 2,000 s.h.p. at 20,400 r.p.m.
One-hour rating 1,575 s.h.p. at 19,400 r.p.m.
Max. continuous rating 1,350 s.h.p. at 18,800 r.p.m.

FUEL CONSUMPTIONS (NGa.1).—
At emergency rating 0.708 lb. (0.321 kg.)/s.h.p./hr.
At one-hour rating 0.730 lb. (0.331 kg.)/s.h.p./hr.
At max. cont. rating 0.773 lb. (0.351 kg.)/s.h.p./hr.

FUEL CONSUMPTIONS (NGa.2).—
At emergency rating 0.676 lb. (0.307 kg.)/s.h.p./hr.
At one-hour rating 0.720 lb. (0.327 kg.)/s.h.p./hr.
At max. cont. rating 0.769 lb. (0.349 kg.)/s.h.p./hr.

FUEL CONSUMPTIONS (NGa.3).—
At emergency rating 0.664 lb. (0.301 kg.)/s.h.p./hr.
At one-hour rating 0.703 lb. (0.319 kg.)/s.h.p./hr.
At max. cont. rating 0.744 lb. (0.338 kg.)/s.h.p./hr.

FUEL CONSUMPTIONS (NGa.4).—
At emergency rating 0.635 lb. (0.288 kg.)/s.h.p./hr.
At one-hour rating 0.675 lb. (0.306 kg.)/s.h.p./hr.
At max. cont. rating 0.705 lb. (0.320 kg.)/s.h.p./hr.

OIL CONSUMPTION.—
Max. consumption 1 pint (0.57 litre)/hr.

THE NAPIER ELAND.

The Eland is a small-diameter single-shaft turboprop engine of outstanding efficiency, with single-lever control. It first ran in 1952, was type-tested in 1956 and has been flight developed in Vickers Varsity, Airspeed Ambassador (Elizabethan) and Convair-340 and 440 aircraft. The following versions have been announced :—

Eland NEl.1. Initial version with maximum take-off rating of 3,060 e.h.p.

Eland NEl.3. Adaptation of standard engine for helicopter application. Described separately on page 408.

Eland NEl.4. First of new family of Elands with air-cooled turbine-blading and higher temperatures. First run in April, 1955. Rated at 4,000 e.h.p.

Eland NEl.5. Development of NEl.4, dimensionally interchangeable with NEl.1 and 6. Further increase in compressor mass flow and compression ratio (8 : 1). Rated at 4,200 e.h.p.

Eland NEl.6. Basically similar to NEl.1, but with turbine blades of different material, permitting higher working temperatures, and increased mass flow. Rated at 3,500 e.h.p.

Napier are offering Eland conversion kits to operators of Convair-Liner 340 and 440, Lockheed Constellation and certain other airliners, by which these aircraft can be converted easily to turboprop power. An initial order has been received from REAL (Brazil) for the conversion of three Convair 340's.

The following constructional details apply specifically to the Eland NEl.1, except where otherwise stated :—

TYPE.—Turboprop engine with ten-stage axial compressor, six combustion chambers and three-stage turbine.

AIRSCREW DRIVE.—Compound epicyclic reduction gear, incorporating hydraulic torquemeter, driven from extension of compressor shaft. Following gear ratios can be provided : .0714, .0773, .0838 or .0912.

AIR INTAKE.—Annular forward facing intake surrounding reduction-gear casing immediately behind airscrew. Inner wall of intake anti-iced by reduction gear oil, outer wall by oil-heated jackets. Six spats in intake anti-iced by oil and variable-inlet guide vanes by air tapped from compressor.

COMPRESSOR.—Ten-stage axial compressor. Aluminium compressor casing cast in halves. Compressor shaft on ball and roller bearings at front and roller bearing at rear. Aluminium bronze blades throughout, the rotor blades being secured by "fir-tree" roots to aluminium and steel discs which, in turn, are splined to compressor shaft. First four stater stages of shrouded type, remainder of cantilever type. Compression ratio 7 : 1 (8 : 1 on NEl.5).

COMBUSTION CHAMBERS.—Six detachable tubular chambers. Outer casings of S.84 material, flame tubes in DTD.703. Upstream injection type burners. High energy spark ignition in two chambers. Chambers secured by clamping rings which, when released, permit each chamber to be withdrawn independently through turbine support frame.

FUEL SYSTEM.—Single-lever control operates an interconnected propeller governor and fuel metering unit, with automatic compensation for variations in altitude and forward speed; and embodies an acceleration control to ensure surge-free accelerations. This control is based on variable datum turbine inlet temperature control interconnected with engine speed. A hydraulic torquemeter in the reduction gear casing includes a reverse torque sensing device arranged to feather the propeller in event of engine failure.

FUEL GRADE.—Wide-cut gasoline (D.E.R.D. 2486) or Aviation turbofuel (D.E.R.D. 2482).

TURBINE.—Three-stage axial-flow with air-cooled blades on NEl.4 and 5 versions. First stage nozzle blades cast in X40 material and are secured in inner and outer rings. Second and third stage nozzle blades, cast in same material with inner and outer

platforms, are bolted to external turbine casing. First stage rotor blades are in Nimonic 90, second and third stages in Nimonic 80A. Rotor blades have "fir-tree" type root fittings. Turbine rotor discs, in H40 material, splined to shaft. Turbine shaft supported at front end by gear type coupling driving compressor, and at rear end by ball bearing.

JET PIPE.—Fixed nozzle type. Pipe and cone of Nimonic 75.

ACCESSORY DRIVES.—Accessories are mounted on reduction gear casing and are driven from front of compressor shaft. A splined shaft is provided for an aircraft accessory gear box and is situated above front end of compressor. Pressure oil pump, torque-meter pump and scavenge pumps are driven from a shaft at rear end of airscrew shaft and are mounted below engine. Fuel pump, tachometer and airscrew governor are driven from accessory gear-box drive and are mounted on top of engine.

LUBRICATION SYSTEM.—Pressurised jet feeds to bearings and gearing. Oil pressure and main scavenge pumps are of gear type, auxiliary scavenge pumps for compressor and turbine bearings are of vane type. All these components are manufactured by Napier. Normal oil pressure 80 lb./sq. in. (5.6 kg./cm.²).

OIL SPECIFICATION.—DERD.2487.

MOUNTING.— Single - plane type. Three mounting pads on support plate at rear of compressor.

STARTING.—Rotax electric starter, Type C.9401, mounted above front end of compressor casing, drives engine *via* accessory gear-box drive.

DIMENSIONS.—
Diameter $36\frac{1}{16}$ in. (91.6 cm.).
Length overall (from front end of airscrew shaft to turbine exit flange) $105\frac{3}{8}$ in. (267 cm.).
Frontal area 7.1 sq. ft. (0.66 m.²).

WEIGHT (NEl.1).—
Dry 1,575 lb. (715 kg.).
Complete with starter and governor 1,661 lb. (754 kg.).

WEIGHT (NEl.4 and 5).—
Dry 1,800 lb. (817 kg.) + $2\frac{1}{2}$%.

WEIGHT (NEl.6).—
Dry 1,625 lb. (738 kg.) + $2\frac{1}{2}$%.

PERFORMANCE (NEl.1 in S/L. Static I.C.A.N. conditions).—
Max. take-off 2,750 s.h.p., plus 805 lb. (365 kg.) net jet thrust at 12,500 r.p.m. (3,060 equivalent h.p.).
Max. continuous 2,070 s.h.p. plus 675 lb. (306 kg.) net jet thrust, at 12,000 r.p.m. (2,330 equivalent h.p.).
Typical cruising 1,665 s.h.p., plus 585 lb. (265.6 kg.) net jet thrust, at 11,500 r.p.m. (1,890 equivalent h.p.).

PERFORMANCE (NEl.4 in S/L. Static I.C.A.N. conditions).—
Max. take-off 3,765 s.h.p. plus 610 lb. (277 kg.) net thrust at 12,500 r.p.m. (4,000 equivalent h.p.).
Max. continuous 3,005 s.h.p. plus 515 lb. (234 kg.) net thrust at 12,000 r.p.m. (3,205 equivalent h.p.).

PERFORMANCE (NEl.5 in S/L. Static I.C.A.N. conditions).—
Max. take-off 3,765 s.h.p. plus 1,130 lb. (513 kg.) net jet thrust at 12,500 r.p.m. (4,200 equivalent h.p.).
Max. continuous 3,020 s.h.p. plus 940 lb. (426 kg.) net jet thrust at 12,000 r.p.m. (3,380 equivalent h.p.).
Typical cruising 2,470 s.h.p. plus 800 lb. (363 kg.) net jet thrust at 11,500 r.p.m. (2,780 equivalent h.p.).

PERFORMANCE (NEl.6 in S/L. Static I.C.A.N. conditions).—
Max. take-off 3,150 s.h.p. plus 915 lb. (415 kg.) net jet thrust at 12,500 r.p.m. (3,500 equivalent h.p.).
Max. continuous 2,605 s.h.p. plus 775 lb. (351 kg.) net jet thrust at 12,000 r.p.m. (2,905 equivalent h.p.).
Typical cruising 2,045 s.h.p. plus 615 lb. (279 kg.) net jet thrust at 11,500 r.p.m. (2,280 equivalent h.p.).

FUEL CONSUMPTIONS (NEl.1).—
At max. T.O. output 0.64 lb. (0.29 kg.) /e.h.p./hr.
At max. continuous output 0.68 lb. (0.31 kg./)e.h.p./hr.

FUEL CONSUMPTION (NEl.4).—
At max. take-off output 0.560 lb. (0.25 kg.) per e.h.p./hr.
At max. continuous output 0.586 lb. (0.26 kg.) per e.h.p./hr.

FUEL CONSUMPTION (NEl.5).—
At max. take-off output 0.560 lb. (0.254 kg.) per e.h.p./hr..
At max. continuous output 0.580 lb. (0.263 kg.) per e.h.p./hr.
At typical cruising output 0.600 lb. (0.272 kg.) per e.h.p./hr.

FUEL CONSUMPTION (NEl.6).—
At max. take-off output 0.595 lb. (0.270 kg.) per e.h.p./hr.
At max. continuous output 0.610 lb. (0.277 kg.) per e.h.p./hr.
At typical cruising output 0.650 lb. (0.295 kg., per e.h.p./hr.

OIL CONSUMPTION.—
2 pints (1.1 litres) per hour.

THE NAPIER ELAND N.El.3.

This engine is an adaptation of the standard engine for helicopter application. It consists of an Eland turboprop engine with an auxiliary compressor mounted co-axially at the rear. This compressor when required is driven from the turbine *via* a hydraulic coupling.

Two Eland N.El.3 engines power each of the Fairey Rotodyne prototypes.

Design details of the N.El.3 are as for the N.El.1. Details of the additional components follow.

AUXILIARY COMPRESSOR.—Nine-stage axial-flow compressor with rearward-facing intake. Compressor rotor on ball bearing at inlet end and roller bearing at outlet. Aluminium-bronze blades used throughout. First three stator stages of shrouded type, remainder of cantilever type.

HYDRAULIC COUPLING.—Of traction type with two impellers driven from engine shaft and two runners on a common shaft driving auxiliary compressor. Oil for filling coupling supplied from main pressure line by means of separate booster pump, and this oil also used for cooling the coupling when not driving compressor.

JET PIPE.—Bifurcated type, each pipe with fixed nozzle.

LUBRICATION SYSTEM.—Pressure jet feeds to bearings and gearing. All pumps of gear type and manufactured by Napier. Main oil pressure 80 lb./sq. in. (5.625 kg./cm.²).

MOUNTING.—A frame bolted to pads on main support plate forms the engine mounting structure and is bolted direct to aircraft bulkhead mounting fitments.

DIMENSIONS.—
Diameter 36.0625 in. (91.6 cm.).
Length (from front of airscrew shaft to auxiliary compressor inlet flange) 158.25 in. (402 cm.).
Frontal area 7.1 sq. ft. (0.65 m.²).

WEIGHT DRY.—
Including engine mounting frame but without final jet pipes 2,350 lb. (1,067 kg.) + $2\frac{1}{2}$%.

PERFORMANCE (S/L. Static I.C.A.N. conditions). -
Max. take-off 2,805 s.h.p. plus 500 lb. (227 kg.) net thrust at 12,500 r.p.m. (3,000 equivalent h.p.).
One hour rating 2,500 s.h.p. plus 480 lb. (218 kg.) net thrust at 12,500 r.p.m. (2,685 equivalent h.p.).
Max. continuous 2,180 s.h.p. plus 420 lb. (191 kg.) net thrust at 12,000 r.p.m. (2,340 equivalent h.p.).

FUEL CONSUMPTIONS.—
At max. take-off output 0.625 lb. (0.28 kg.) per e.h.p./hr.
At one-hour rating output 0.644 lb. (0.29 kg.) per e.h.p./hr.
At max. continuous output 0.663 lb. (0.30 kg.) per e.h.p./hr.

OIL CONSUMPTION.—
2 pints (1.1 litres) per hour.

THE NAPIER N.R.E.17 ROCKET.

Two versions of the N.R.E.17 liquid-propellent rocket engine were shown at the 1955 S.B.A.C. Display. The first had a regeneratively-cooled chamber machined from steel forgings, with the fuel feed entering at the throat. The other, probably in production form, was a sheet steel structure. Intended for missile applications, the N.R.E.17 develops approximately 2,000 lb. (907 kg.) s.t., running on hydrogen peroxide and kerosene.

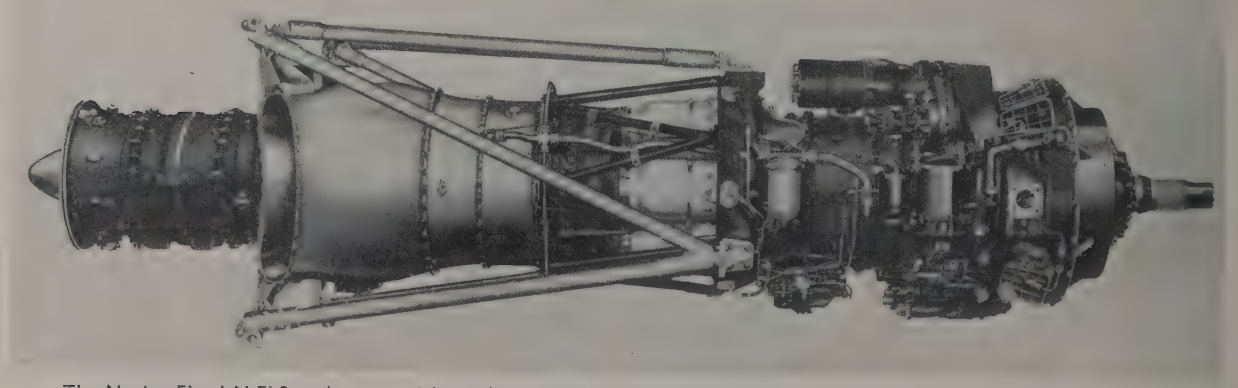
THE NAPIER N.R.E. 19 ROCKET.

First shown at the 1956 S.B.A.C. Display, the N.R.E. 19 is one of a series of miniature rocket motors designed for rotor-tip application to increase the rate-of-climb of helicopters. It was demonstrated on the rotor of a Saunders-Roe Skeeter, being supplied from a tank of high test peroxide propellent mounted above the rotor hub. Weight of the complete system, (dry) was stated to be under 30 lb. (13.6 kg.).

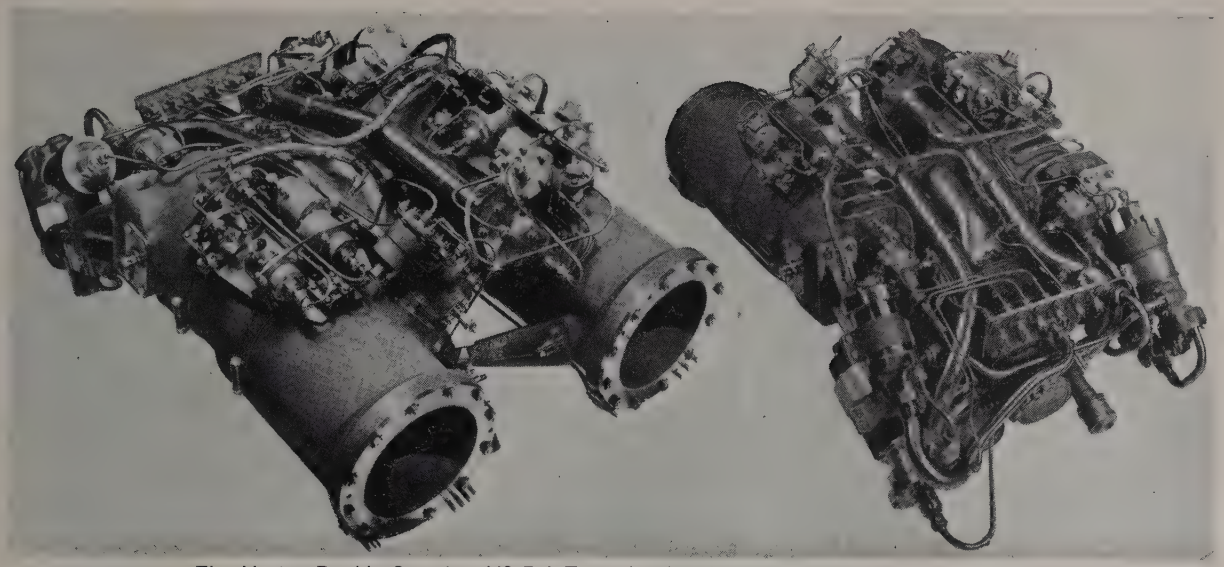
The N.R.E. 19 consists of a catalyst cylinder and rocket outlet weighing just over 1 lb. (0.45 kg.) and giving 22-25 lb. (10-11.35 kg.) s.t. for a consumption of 1 Imp. gallon (4.55 litres) of fuel each minute.

THE NAPIER N.R.J. 1 RAMJET.

The N.R.J. 1 ramjet was produced for the National Gas Turbine Establishment in the form of a ramjet test vehicle (RJTV) used to obtain data on fuel system and combustion performance. It has a pitot-type intake giving a single normal shock. The RJTV is 20 ft. (6.10 m.) long and has a diameter of approximately 18 in. (460 mm.). It set up a British height record for vehicles of its type early in 1956.



The Napier Eland N.El.3 turboprop with auxiliary compressor. Two engines of this type power the Fairey Rotodyne.



The Napier Double Scorpion NScD.1 Twin-chamber Liquid-propellent Rocket motor.

THE NAPIER SCORPION.

Designed and built at the Napier Flight Development Establishment at Luton, the Scorpion NSc.1 is a liquid-propellent (high test peroxide and kerosene) rocket motor which made its first ground runs on May 19, 1956. An initial air firing was made successfully on the following day, with the Scorpion mounted inside the bomb-bay of a modified Canberra aircraft.

A mock-up of a single-chamber engine of the Scorpion type was shown at the 1957 Paris *Salon*, and the Double Scorpion, of which brief details were released in August, 1957, is made up of two units of this type. The chambers have a diameter of approximately 8 in. (203 mm.), are individually controllable and regeneratively cooled. The propellents are pump-fed.

No further details of the Scorpion or Double Scorpion are available, but the latter has a length of 32 in. (813 mm.) and is 23 in. (584 mm.) wide.

An English Electric Canberra B.2, fitted with a Double Scorpion auxiliary rocket-motor in a bomb-bay installation, set up a World Aeroplane Height Record of 70,000 ft. (21,336 m.) on August 28, 1957. Simultaneously it was announced that the Double Scorpion is in production as an auxiliary power unit for high-altitude interceptors, presumably including the English Electric P.1B.

The Aerojet-General Corporation of America have acquired the licence to build the Scorpion.

ROLLS-ROYCE

ROLLS-ROYCE, LIMITED.

HEAD OFFICE: DERBY.

WORKS: DERBY, CREWE AND GLASGOW.

LONDON OFFICE: 14-15, CONDUIT STREET, W.1.

Established: March 15, 1906.

Directors: Lord Kindersley, C.B.E., M.C. (Chairman); J. D. Pearson, J.P., Wh.Sc., B.Sc. (Deputy Chairman and Chief Executive, Aero Engine Division); Whitney W. Straight, C.B.E., M.C., D.F.C. (Deputy Chairman); Harold Peake, M.A.; W. T. Gill, C.A.; Dr. F. Llewellyn Smith, M.Sc., D.Phil. (Managing Director, Motor Car Division); W. A. Robotham (Managing Director, Oil Engine Division); A. A. Rubbra; A. F. Kelley; F. T. Hinkley (General Manager, Sales and Service); W. P. Calvert.

At the end of 1941, under instructions from the Ministry of Aircraft Production, Rolls-Royce undertook the development and manufacture of the Whittle-type engine in conjunction with Power Jets, Ltd. and the Rover Company.

The first Rolls-Royce version of the Whittle W2B/23 jet-propulsion engine passed its 100-hour type test in April, 1943, and was named the Welland. It was thus the first of the long series of Rolls-Royce gas-turbine engines to be named after English rivers, these names being chosen to give the idea of flow associated with jet-propulsion.

Production deliveries of the Welland began in May, 1944, to power the Gloster Meteor twin-jet fighter, later versions of which were fitted with Rolls-Royce's second turbojet, the Derwent.

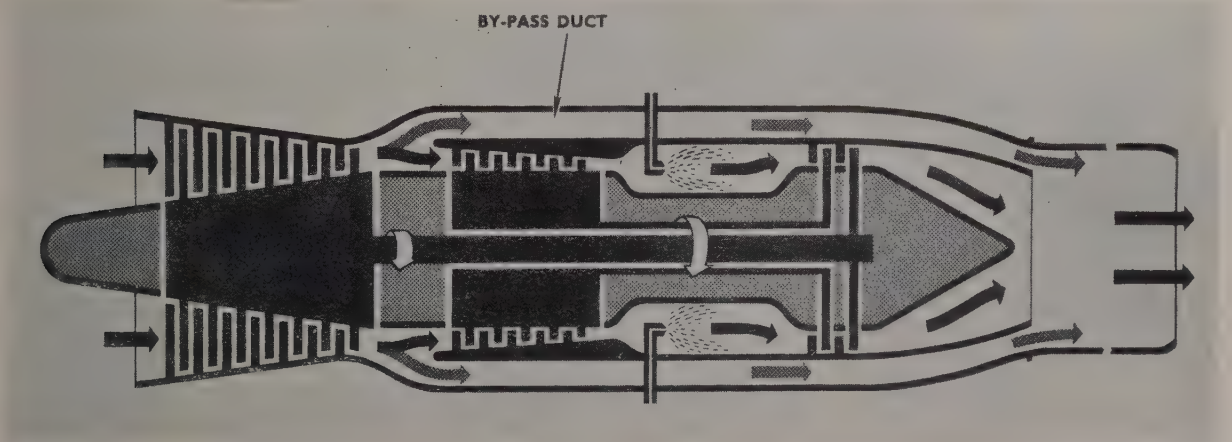
The Nene, a parallel development of the Derwent which it resembles in general features and layout, was first run in October, 1944, and has been built in large numbers in Australia, France and the United States, as well as by Rolls-Royce. From it was developed the Tay which has also been built in quantity by Pratt & Whitney in the U.S.A. and Hispano-Suiza in France.

The Avon engine, the first Rolls-Royce axial-flow engine to go into production, is being manufactured by the Rolls-Royce group of factories in the United Kingdom, and under licence in Australia, Belgium and Sweden. Hispano-Suiza have a licence to produce it in France.

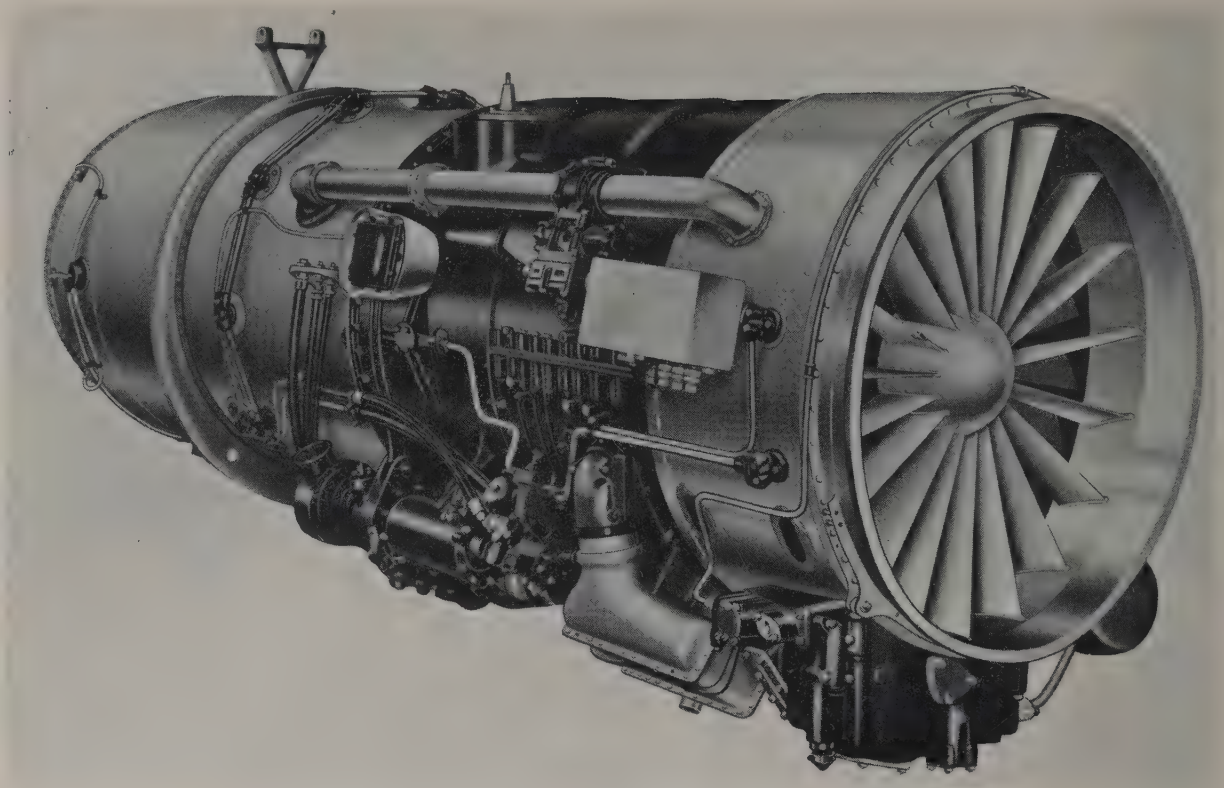
Also in production is the Rolls-Royce Dart turboprop engine, four of which power the Vickers Viscount, which was the World's first turboprop-powered airliner to go into regular service.

Under current development are advanced versions of the Avon and Dart; the Soar high specific-thrust turbojet; the Conway by-pass turbojet, which has been chosen to power versions of the Boeing 707 and Douglas DC-8 transport aircraft; and the RB.109 Tyne turboprop, four of which will be fitted to the Vickers Vanguard transport.

The company has signed a licence agreement with North American Aviation,



A diagram showing the "by pass" principle as applied to the Rolls-Royce Conway engine.



The Rolls-Royce Conway RCo.10 turbojet engine (16,500 lb.=7,485 kg. s.t.).

Inc., under which it will manufacture and develop high-thrust rocket-motors using techniques evolved originally by the U.S. company.

In partnership with Vickers and Foster Wheeler, Rolls-Royce formed a new company known as Vickers Nuclear Engineering, Ltd. early in 1956. Previously, it had been announced that Rolls-Royce is working on the development of lightweight nuclear reactors for aircraft and surface transport applications, and that these activities are centered in a new nuclear engineering laboratory near Derby.

Rolls-Royce will provide the reactor for H.M.S. *Dreadnought*, the first British atomic-powered submarine.

THE ROLLS-ROYCE CONWAY.

The Conway is an axial-flow engine of the "by-pass" type. The "by-pass" engine resembles the normal jet engine but has an additional duct through which some of the air from the compressor by-passes the combustion chambers and re-enters the jet stream aft of the turbine.

The advantage of this type of engine over the straight-through jet is that although the by-pass engine works at a high pressure ratio, giving high internal efficiency, it also produces by means of the by-pass a final jet containing a greater mass of air moving at a lower speed, which gives a higher propulsive efficiency. The result of this arrangement is to improve the specific fuel consumption. Compared with a straight turbojet of the same thrust, the "by-pass" engine is lighter.

The lower jet velocity in conjunction with the latest form of Rolls-Royce jet nozzle helps to reduce jet noise. Fire protection is assisted by the duct of cool air which surrounds the hot part of the engine.

These qualities make the Conway particularly suitable for large long-range civil airliners, and it has been specified for versions of the Boeing 707 and Douglas DC-8 transports, as well as for the Vickers VC10 airliner. It also has obvious military applications, combining fuel economy with tremendous power when fitted with an afterburner, and four Conways will power the Handley Page Victor B. Mk. 2 bomber. Meanwhile, the prototype Avro Vulcan (VX770) has been fitted experimentally with four Conways for flight development. Flight tests of the Conway were previously made in an Ashton research aircraft.

No constructional details of the Conway may be published, but it is known to have multi-stage low-pressure and high-pressure compressors, an annular combustion chamber with 10 Duplex burners, and two sets of mechanically independent turbine stages. Versions so far announced are the RCo.2 (9,250 lb.=4,196 kg. s.t.), the RCo.3 (11,500 lb.=5,217 kg. s.t.), the RCo.5 which completed a type test at 13,000 lb. (5,897 kg.) s.t. with the lowest specific fuel consumption of any turbojet yet tested, the RCo.7 (13,000 lb.=5,897 kg. s.t.) and the RCo.8 and RCo.11 of unspecified power. The version for the Douglas DC-8 is the RCo.10, rated at 16,500 lb. (7,485 kg.) s.t.

DIMENSIONS.—
Diameter overall 42 in. (1.067 mm.).
Length 132.45 in. (3,365 mm.).

THE ROLLS-ROYCE RB.108.

It was announced in November, 1955 that Rolls-Royce was developing a new gas-turbine engine under the designation of RB.108.

Five RB.108's are installed in the Short SC.1 experimental VTO aircraft.

No details of the RB.108 were available for publication at the time of writing.

THE ROLLS-ROYCE SOAR.

The Soar is a small axial-flow turbojet engine of extremely simple construction and with a record specific weight of 0.148 lb. per pound of thrust. The Soar RSr.1 gave 1,760 lb. (798 kg.) s.t. The Soar RSr.2 has been type-tested at 1,860 lb. (844 kg.) s.t. and is in production with a static thrust rating of 1,810 lb. (821 kg.).

First flight tests of the Soar were made with two of them mounted on the wingtips of a Gloster Meteor. The Italian Aerfer Ariete fighter will use a Soar; others power the American Radioplane jet target drone, which is able to exceed Mach 1.0.

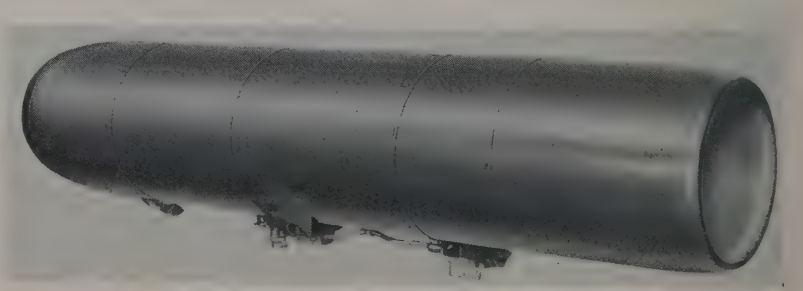
No structural details of the Soar were available for publication at the time of writing, but its external appearance may be seen in the accompanying illustration.

DIMENSIONS.—
Overall diameter 15.8 in. (40 cm.).
Length 58.95 in. (150 cm.) without air intake 77 in. (196 cm.) with air intake.

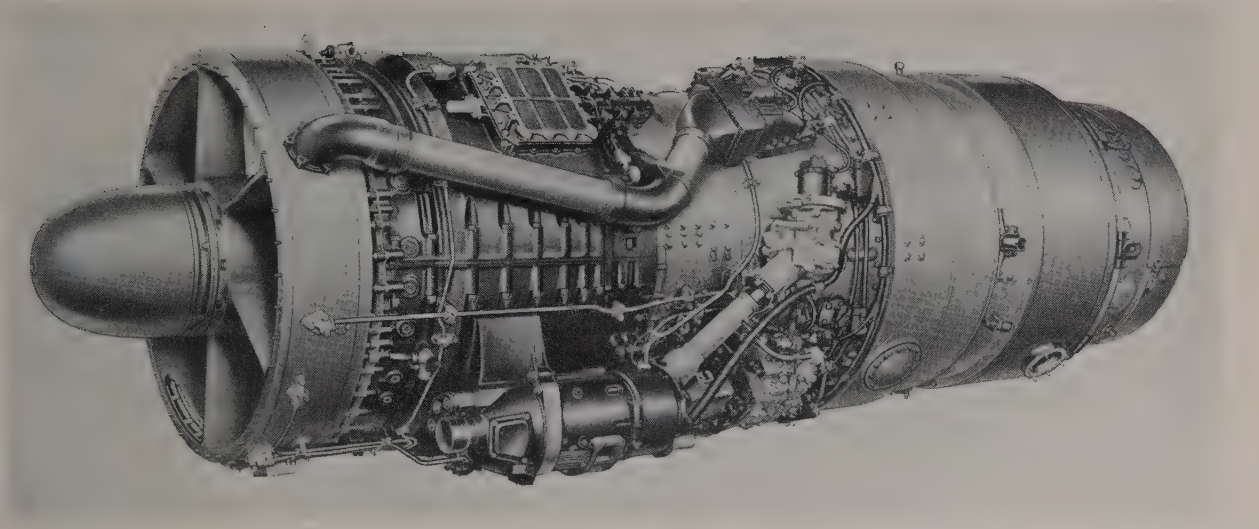
NET DRY WEIGHT.—
267 lb. (121 kg.) without air intake, 275 lb. (125 kg.) with air intake.

PERFORMANCE.—
Max. static thrust 1,810 lb. (822 kg.).

CONSUMPTION.—
Fuel 1.27 lb./lb. s.t./hr. (1.27 kg./kg. s.t./hr.).



The Rolls-Royce Soar RSr.2 light turbojet engine.



The Rolls-Royce Avon RA.29 turbojet engine (10,500 lb.=4,767 kg. s.t.).

THE ROLLS-ROYCE AVON.

The Avon axial-flow turbojet was developed after the war to replace the Nene. It has been in large-scale production both in the United Kingdom and overseas for many years and powers a very large number of military and civil types.

The original 100-Series Avons had a 12-stage compressor and eight individual combustion chambers. The later 200-Series engines are of almost entirely new design with higher pressure ratio compressors, annular combustion chambers and considerably higher power. Both series are in production.

Details of some of the more important Avon variants are given in the table below. The full list of models so far announced is as follows :—

RA.1. Development batch only, with eight or ten-stage compressors and single-stage turbine. Basic S/L. s.t. rating 6,500 lb. (2,950 kg.).

RA.2. Improved version with 12-stage compressor of greater diameter. Single-stage turbine. First flown in Lancastrian test bed August 15, 1948. S/L. rating 6,000 lb. (2,720 kg.) s.t.

RA.3. Two-stage turbine. Type-tested at 6,500 lb. (2,950 kg.) s.t. Production began in June, 1950.

RA.7. Basic S/L. s.t. rating 7,500 lb. (3,402 kg.). Type-tested in March, 1952. Thermal anti-icing. Seven versions of RA.7 rating engine in production. First deliveries to aircraft manufacturers in September, 1952. Built under licence in Australia, etc.

RA.7R. RA.7 with re-heat. Type-tested in January, 1953 at 9,450 lb. (4,290 kg.) S/L. static thrust with re-heat. Variable-area jet-pipe nozzle.

RA.14. First of the 200-Series of Avons with high-pressure ratio compressor and annular combustion chamber. Type-tested in April, 1953, at a thrust of 9,500 lb. (4,310 kg.) without re-heat. Since then the engine has been continuously and progressively developed in flight to give powers well into five figures. For fighter installation the RA-14 will be fitted with re-heat. Production and delivery of the RA.14 began only twenty months after the running of the first engine on November 17, 1951.

RA.16. Rated at 9,000 lb. (4,082 kg.) s.t.

RA.18. Rated at 11,300 lb. (5,125 kg.) s.t.

RA.21. Production development of RA.7 type up-rated to 8,000 lb. (3,628 kg.) s.t. Compression ratio 6.4 : 1. Air mass flow 124 lb./sec. (56 kg./sec.).

RA.22. Rated at 7,150 lb. (3,243 kg.) s.t.

RA.23. Rated at 10,500 lb. (4,767 kg.) s.t.

RA.24 (200-Series). Passed type test at a rating of 11,250 lb. (5,103 kg.) s.t. in July, 1956. Also RA.24R with reheat. In production.

RA.25. Basic S/L. s.t. rating 7,300 lb. (3,310 kg.).

RA.26 (**Mk. 521**). Civil version of RA.28. 10,000 lb. (4,540 kg.) s.t. Weight 2,790 lb. (1,267 kg.). Powers the Sud Aviation Caravelle prototype.

RA.28 (200-Series). First Avon to be type-tested at 10,000 lb. (4,540 kg.) s.t.

RA.29 (200-Series). Civil engine rated at 10,500 lb. (4,767 kg.) s.t. Under development to power the Comet Series 4 and production Caravelle.

RA.30. Rated at 10,000 lb. (4,540 kg.) s.t.

RA.50. Rated at 9,100 lb. (4,131 kg.) s.t.

A special version of the 200-Series Avon has been produced for vertical

ROLLS-ROYCE AVON AXIAL-FLOW TURBOJET ENGINES.

Type	Thrust (Basic S/L. rating)	Specific Fuel Consumption (max. T.O. conditions)	Net Dry Weight (approx.)	Power/Weight Ratio	Length (without jet pipe)	Diameter
RA.3	6,500 lb. (2,950 kg.)	0.88 lb./hr./lb. (0.88 kg./hr./kg.)	2,240 lb. (1,016 kg.)	2.90 lb. s.t./lb. (2.90 kg. s.t./kg.)	102.1 in. (2,593 mm.)	42.225 in. (1,072 mm.)
RA.7	7,500 lb. (3,402 kg.) at 7,950 r.p.m.	0.92 lb./hr./lb. (0.92 kg./hr./kg.)	2,460 lb. (1,116 kg.)	3.05 lb. s.t./lb. (3.05 kg. s.t./kg.)	102.1 in. (2,593 mm.)	42.225 in. (1,072 mm.)
RA.7R	9,500 lb. (4,310 kg.) (with reheat) at 7,950 r.p.m.	1.90 lb./hr./lb. (1.90 kg./hr./kg.) (with reheat)	2,960 lb. (1,343 kg.) (with reheat jet pipe)	3.20 lb. s.t./lb. (3.20 kg. s.t./kg.)	120 in. (3,048 mm.)	42.225 in. (1,072 mm.)
RA.14	9,500 lb. (4,310 kg.)	0.84 lb./hr./lb. (0.84 kg./hr./kg.)	2,860 lb. (1,297 kg.)	3.32 lb. s.t./lb. (3.32 kg. s.t./kg.)	113.3 in. (2,877 mm.)	41.5 in. (1,054 mm.)
RA.21	8,000 lb. (3,628 kg.) at 8,100 r.p.m.	0.925 lb./hr./lb. (0.925 kg./hr./kg.)	2,520 lb. (1,143 kg.)	3.17 lb. s.t./lb. (3.17 kg. s.t./kg.)	102.1 in. (2,593 mm.)	42.225 in. (1,072 mm.)
RA.24	11,250 lb. (5,103 kg.)	—	—	—	117.5 in. (2,985 mm.)	42 in. (1,067 mm.)
RA.26 (Civil)	10,000 lb. (4,540 kg.)	0.86 lb./hr./lb. (0.86 kg./hr./kg.)	2,790 lb. (1,265 kg.)	3.58 lb. s.t./lb. (3.58 kg. s.t./kg.)	113.3 in. (2,877 mm.)	41.5 in. (1,054 mm.)
RA.28	10,000 lb. (4,540 kg.)	0.86 lb./hr./lb. (0.86 kg./hr./kg.)	2,890 lb. (1,311 kg.)	3.46 lb. s.t./lb. (3.46 kg. s.t./kg.)	113.3 in. (2,877 mm.)	41.5 in. (1,054 mm.)
RA.29 (Civil)	10,500 lb. (4,767 kg.)	0.775 lb./hr./lb. (0.775 kg./hr./kg.)	3,341 lb. (1,517 kg.)	3.14 lb. s.t./lb. (3.14 kg. s.t./kg.)	113.3 in. (2,877 mm.)	42 in. (1,067 mm.)
RA.50	9,100 lb. (4,131 kg.)	—	—	—	—	—

take-off aircraft and one of these powers the Ryan X-13 experimental V.T.O. aircraft.

The following details apply to the 100-Series RA.7 and RA.7R Avon engine :

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular type surrounding starter bullet. Provision for thermal (hot air) de-icing. Inlet air flow 120 lb./sec. (54 kg./sec.).

COMPRESSOR.—Twelve-stage axial-flow. Rotor blades secured by pins to the rotor discs which are splined on to shaft. First eight rows of discs and blades of forged RR.58 aluminium alloy. Last four rows have discs forged from S.62 steel and blades of D.T.D. 197-type aluminium bronze. First seven rows of stator blades made from RR.58 aluminium alloy, next four rows from D.T.D. 197-type aluminium bronze, and last row (carried by outlet casing) of precision cast H.R. Crown Max steel. Stator blades secured in grooves in upper and lower halves of RR.250 aluminium alloy compressor casing. Total of 1,018 rotor blades and 1,195 stator blades. First four rows of stator blades shrouded. Compressor shaft carried on front roller bearing and rear ball bearing. Compression ratio 6.5 : 1. Air mass flow 120 lb./sec. (54 kg./sec.).

COMBUSTION CHAMBER.—Eight interconnected straight-flow type made from Nimonic 75 alloy. Duple fuel atomizers at forward end of combustion chambers. High-energy type ignition with plugs in Nos. 3 and 6 chambers.

FUEL SYSTEM.—Low-pressure system with Lucas Twin-D pump and barometric control unit.

FUEL GRADE.—D.E.R.D.2482 and 2486.

NOZZLE GUIDE VANES.—Sixty-seven low-pressure vanes of special Rolls-Royce heat-resisting steel. Seventy-six high-pressure vanes of H.R. Crown Max steel.

TURBINE.—Two-stage axial turbine with 71 Nimonic 95 blades on low-pressure stage and 103 Nimonic 90 blades on high-pressure stage. All blades shrouded at tips. Blades secured by "fir-tree' roots to turbine discs which are splined to shaft. Roller bearing forward of disc assembly. Gas temperature after turbine 700°C.

JET PIPE.—Fixed type on RA.7 ; variable type on RA.7R with reheat. D.T.D.571 steel jet pipe and inner cone. Max. jet pipe temperature 1,256°F. (679°C.).

ACCESSORY DRIVE.—Off port side of wheelcase to auxiliary gearbox on port side.

LUBRICATION SYSTEM.—Closed circuit pressure type, using Rolls-Royce pumps. Sump combined with tank and mounted on flange below compressor outlet casing. Oil capacity 2 Imp. gallons (9 litres). Oil supply pressure 15 lb./sq. in. (1.05 kg./cm.²).

OIL SPECIFICATION.—D.E.R.D.2487.

MOUNTING.—Main trunnions on each side of nozzle box ahead of turbine. Forward mounting framework at compressor casing.

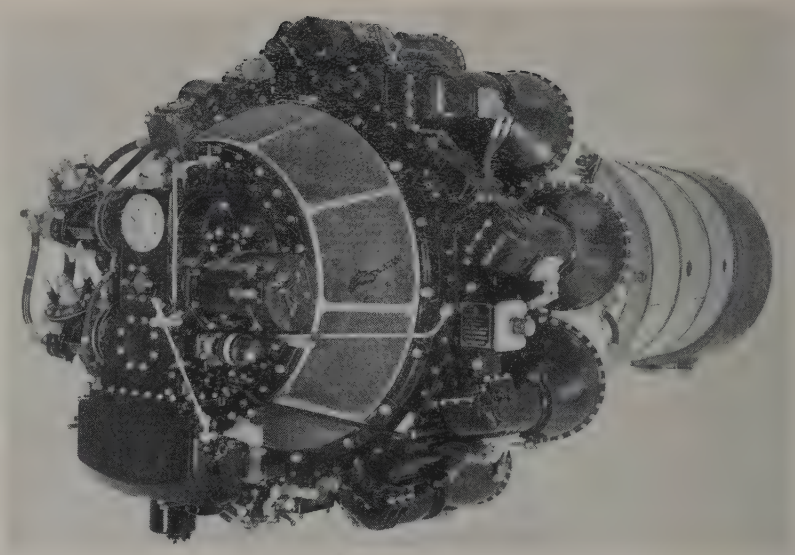
STARTING.—B.T.H. triple-breech cartridge starter in centre of air intake. Alternatively liquid-fuel starter or Rotax electric starter.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See table.

THE ROLLS-ROYCE NENE.

Several versions of the basic Nene engine have been produced and the following are still in production or in widespread use :—

Mk. 10 (RN.2). Similar to Mk. 102 but a larger wheelcase is provided to mount and drive aircraft accessories. Engine adapted for installation in Canadair Silver Star (Lockheed T-33) trainer.



The Rolls-Royce Nene RN.2 Mk. 3 turbojet engine.

Mk. 101 (RN.2). Fitted with front panel of plenum chamber, horizontal gearbox drive, Plessey turbo-starter and two high-energy igniters and a divided jet pipe. This last-mentioned item has the effect of lowering the thrust by 100 lb. (45.4 kg.) to 5,000 lb. (2,268 kg.). Powers the Sea Hawk Mks. 1-4.

RN.3. Basic S/L. s.t. rating 5,500 lb. (2,495 kg.).

RN.4. Special version used for jet-deflection experiments.

Mk. 103 (RN.6). Similar to Mk. 101 but with thrust increased to 5,400 lb. (2,450 kg.). Minor structural changes to accommodate increased working temperatures. Cartridge turbo-starter. Compression ratio 4.54 : 1. Mass air flow 91 lb./sec. (41 kg./sec.). Powers the Sea Hawk 5 and 6.

A full description and specification of the Nene has appeared in previous editions of "All the World's Aircraft." Details of dimensions, weights and performance are given in the accompanying Table.

THE ROLLS-ROYCE TYNE.

The Rolls-Royce Tyne is a two-spool turboprop engine which has been chosen to power the Vickers Vanguard transport aircraft. It first ran in April, 1955, and began its flight testing in the summer of 1956 in the nose of a Lincoln test-bed aircraft. Four Tynes have been ordered by the Lockheed Corporation for testing in a Super Constellation airframe.

Few details of the construction of the Tyne have been published, but it is known to have a multi-stage low-pressure compressor driven by a three-stage low-pressure turbine, a multi-stage high-pressure compressor driven by a single-stage high-pressure turbine and an annular combustion chamber. Compression ratio is 13 : 1.

Overall size has been kept remarkably low by careful design. The compressors are of very small diameter and most of the accessories are packed below the compressor casing. The air intake casing houses an integral oil tank and compound-epicyclic reduction gearing for the airscrew which has a diameter of 14 ft. 6 in. (4.42 m.). Reduction gear ratio for the Vanguard will be 0.064 : 1.

Intended originally to begin with a power of 2,500 s.h.p., where the Dart leaves off, the Tyne has exceeded expectations and the following development stages are planned :—

Stage 1 (RTy.1). Rated at 4,310 b.h.p. (4,795 e.h.p.) for take-off and with 2,455 b.h.p. (2,685 e.h.p.) available for cruising at 425 m.p.h. (685 km.h.) at 25,000 ft. (7,620 m.). Cruising specific fuel consumption 0.405 lb. (0.184 kg.). per e.h.p./hr.

Stage 2 (RTy.10). Rated at 4,885 b.h.p. (5,380 e.h.p.) for take-off and with 2,845 b.h.p. (3,195 e.h.p.) available for cruising at 425 m.p.h. (685 km.h.) at 25,000 ft. (7,620 m.). Cruising specific fuel consumption 0.388 lb. (0.176 kg.) per e.h.p./hr.

Stage 3. Rated at 5,235 b.h.p. (5,760 e.h.p.) for take-off.

DIMENSIONS.—
Overall diameter 40.5 in. (1,030 mm.).
Length 100.25 in. (2,545 mm.).

WEIGHT (RTy.1).—
Dry weight 2,023 lb. (918 kg.).

THE ROLLS-ROYCE DART.

Originally tested in 1945 at a power of some 1,000 h.p., the Dart has undergone continuous development and produces more than double that power in its latest form.

The following are the production versions of the Dart :—

Mk. 505 (R.Da.3). First production model. Reduction gear 0.106 : 1. Mass air flow 20 lb./sec. Shrouded turbine

ROLLS-ROYCE NENE CENTRIFUGAL-FLOW TURBOJET ENGINES.

Type and Mark Number	Thrust (Basic S/L. rating)	Specific Fuel Consumption (max. T.O. conditions)	Net Dry Weight (approx.)	Power/Weight Ratio	Length (without jet pipe)	Diameter
RN.2 Mk. 10	5,100 lb. (2,315 kg.) at 12,500 r.p.m.	1.06 lb./hr./lb. (1.06 kg./hr./kg.)	1,620 lb. (735 kg.)	3.15 lb. s.t./lb. (3.15 kg. s.t./kg.)	104.75 in. (2,660 mm.)	49.5 in. (1,258 mm.)
RN.2 Mk. 101	5,000 lb. (2,268 kg.) at 12,500 r.p.m.	1.085 lb./hr./lb. (1.085 kg./hr./kg.)	1,618 lb. (734 kg.)	3.09 lb. s.t./lb. (3.09 kg. s.t./kg.)	78 in. (1,981 mm.)	49.5 in. (1,258 mm.)
RN.6 Mk. 103	5,400 lb. (2,450 kg.) at 12,700 r.p.m.	1.07 lb./hr./lb. (1.07 kg./hr./kg.)	1,612 lb. (731 kg.)	3.35 lb. s.t./lb. (3.35 kg. s.t./kg.)	78 in. (1,981 mm.)	49.5 in. (1,258 mm.)

ROLLS-ROYCE DART CENTRIFUGAL-FLOW TURBOPROP ENGINES.

Mark Number	Power (Basic S/L. rating)	Specific Fuel Consumption (max. T.O. conditions)	Net Dry Weight (approx.)	Power/Weight Ratio	Length (without jet pipe)	Diameter
Mk. 505	1,540 e.h.p. (1,400 s.h.p. plus 365 lb.=165 kg. jet thrust) at 14,500 r.p.m.	0.753 lb./e.h.p./hr. (0.341 kg./e.h.p./hr.)	1,030 lb. (468 kg.)	1.49 e.h.p./lb. (0.68 e.h.p./kg.)	95 in. (2,413 mm.)	37.9 in. (963 mm.)
Mk. 506	1,540 e.h.p. (1,400 s.h.p. plus 365 lb.=165 kg. jet thrust) at 14,500 r.p.m.	0.727 lb./e.h.p./hr. (0.330 kg./e.h.p./hr.)	1,044 lb. (474 kg.)	1.47 e.h.p./lb. (0.67 e.h.p./kg.)	95 in. (2,413 mm.)	37.9 in. (963 mm.)
Mk. 510	1,740 e.h.p. (1,600 s.h.p. plus 370 lb.=168 kg. jet thrust) at 14,500 r.p.m.	0.690 lb./e.h.p./hr. (0.312 kg./e.h.p./hr.)	1,152 lb. (523 kg.)	1.57 e.h.p./lb. (0.71 e.h.p./kg.)	97.6 in. (2,480 mm.)	37.9 in. (963 mm.)
Mk. 511	1,720 e.h.p. (1,600 s.h.p. plus 310 lb.=140 kg. jet thrust) at 14,500 r.p.m.	0.698 lb./e.h.p./hr. (0.316 kg./e.h.p./hr.)	1,182 lb. (536 kg.)	1.44 e.h.p./lb. (0.66 e.h.p./kg.)	97.6 in. (2,480 mm.)	37.9 in. (963 mm.)
Mk. 520	1,890 e.h.p. (1,700 s.h.p. plus 495 lb.=225 kg. jet thrust) at 15,000 r.p.m.	0.700 lb./e.h.p./hr. (0.317 kg./e.h.p./hr.)	1,250 lb. (567 kg.)	1.51 e.h.p./lb. (0.68 e.h.p./kg.)	97.6 in. (2,480 mm.)	37.9 in. (963 mm.)
Mk. 525	1,990 e.h.p. (1,800 s.h.p. plus 500 lb.=227 kg. jet thrust) at 15,000 r.p.m.	0.680 lb./e.h.p./hr. (0.308 kg./e.h.p./hr.)	1,250 lb. (567 kg.)	1.59 e.h.p./lb. (0.72 e.h.p./kg.)	97.6 in. (2,480 mm.)	37.9 in. (963 mm.)
Mk. 541	2,350 e.h.p. (2,100 s.h.p. plus 655 lb.=297 kg. jet thrust) at 15,000 r.p.m.	0.675 lb./e.h.p./hr. (0.306 kg./e.h.p./hr.)	1,323 lb. (600 kg.)	—	98.5 in. (2,502 mm.)	37.9 in. (963 mm.)

blades. Powered early 700 Series Viscounts.

Mk. 506. As 505 but with various refinements to compressor and turbine blading which give reduced working temperature and better specific fuel consumption. Additional 80-90 s.h.p. under cruise conditions. Powers later 700 Series Viscounts.

Mk. 510 (RDa.6). Reduction gear 0.093 : 1. As 506 but with strengthened reduction-gear, multiple seals on H.P. and L.P. turbine blade shrouds, etc. Powers 700D and early 800 Series Viscounts.

Mk. 511. Reduction gear 0.086 : 1. As 510 but for Fokker F.27 (12-foot diameter airscrews).

Mk. 512. Reduction gear 0.107 : 1. As 510 but for Aviation Traders' Accountant (standard 10-foot diameter airscrews).

Mk. 520 (RDa.7). Reduction gear 0.093 : 1. Ten per cent increased mass air flow (22 lb./sec.), increased capacity compressor, three-stage turbine, fuel system modifications, twin oil-coolers, etc. Powers Viscount 806 and early 810 Series. RDa.7 also powers the Breguet 1050 Alizé three-seat anti-submarine aircraft in production for the French Navy.

Mk. 525 (RDa.7/1). Similar to 520 but with higher flame temperature. Derated for take-off to 1,800 s.h.p. but with 2,100 s.h.p. available for climb and cruise. Powers later 810 Series Viscounts.

Mk. 526 (RDa.7/2). Rated at 1,910 s.h.p. (2,100 e.h.p.). For AW.650.

Mk. 527 (RDa.7/2). Rated at 1,910 s.h.p. (2,100 e.h.p.). For Handley Page Herald.

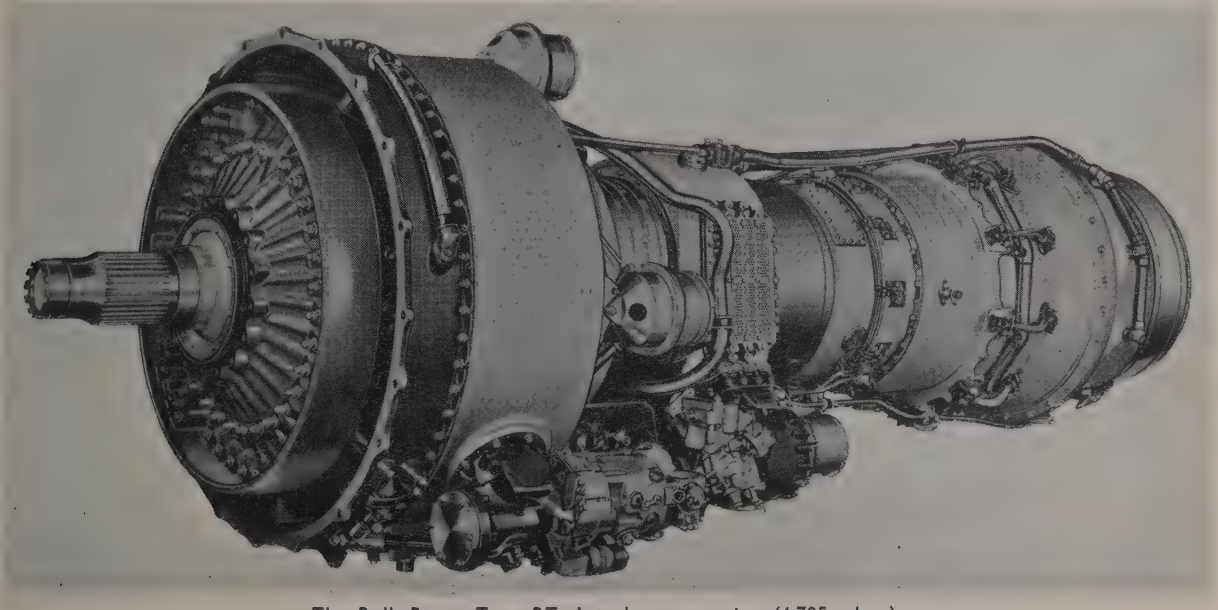
Mk. 528 (RDa.7/1). Rated at 1,800 s.h.p. (1,960 e.h.p.). For Fokker Friendship.

Mk. 529 (RDa.7/2). Rated at 1,910 s.h.p. (2,100 e.h.p.). For Grumman Gulfstream.

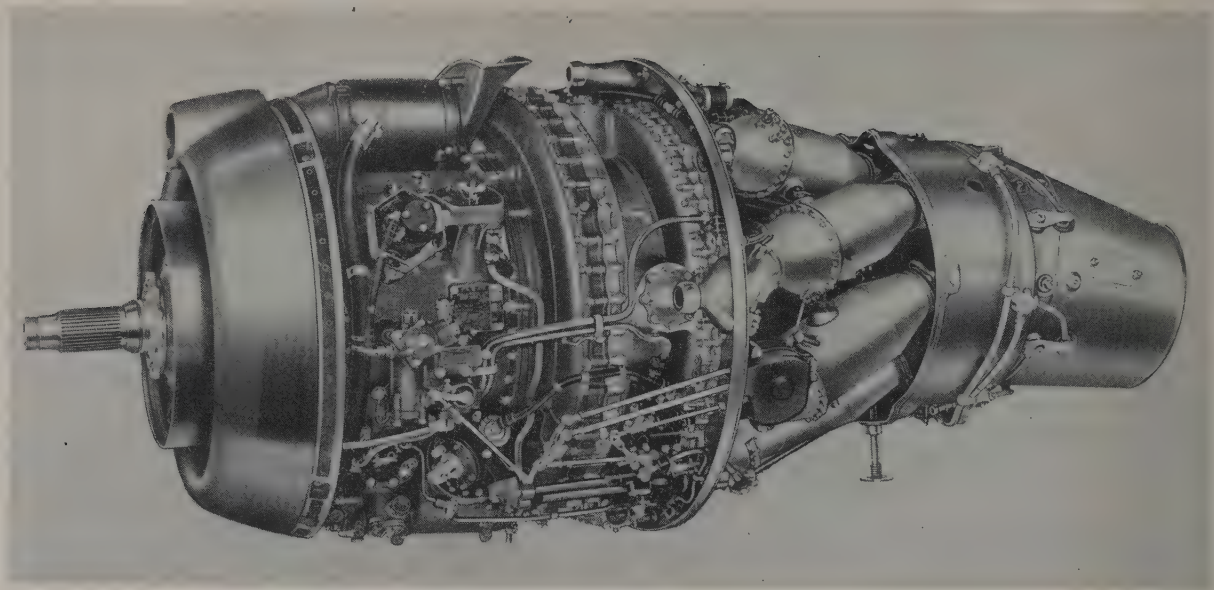
RDa.10. Fully-rated version. 2,395 s.h.p. (2,655 e.h.p.).

Mk. 541 (RDa.11). Increased mass air flow over that of 520, increased capacity compressor, higher flame temperature, air-cooled turbine blades, strengthened reduction-gear, etc. For 840 Series Viscounts.

Ratings, weights and dimensions of



The Rolls-Royce Tyne RTy.1 turboprop engine (4,795 e.h.p.).



The 1,740 e.h.p. Rolls-Royce Dart Mk. 510 turboprop engine.

the above engines will be found in the accompanying Table.

The following details apply specifically to the Dart Mk. 505, 506 and 510 engines :

TYPE.—Turboprop with two-stage centrifugal compressor and two-stage turbine.

REDUCTION GEAR.—Double reduction gearing with helical high-speed train and final spur gear drive. The two gear trains connected by three layshafts. High-speed sun-wheel driven from forward end of impeller shaft with final drive through a large annulus splined to airscrew shaft. All gears and airscrew shaft carried in roller or ball bearings. Bevel gears from one of the layshafts provide drives to fuel and oil pumps and constant-speed unit. Bevel gear and engaging mechanism on sun-wheel shaft provide drive from starter motor. Reduction gear ratio 0.106 : 1 (505 and 506), 0.093 : 1 (510).

AIR INTAKE.—Circular intake with annular duct leading to impeller eye of first-stage compressor. Oil tank around intake is cast integral with casing. Secondary air intake supplies air to oil cooler mounted on top of casing.

COMPRESSOR.—Two - stage centrifugal-flow compressor. Each impeller has nineteen vanes and steel rotating guide vanes. Mass air flow at maximum r.p.m. 20 lb./sec. (9.1 kg./sec.) at 5.5 : 1.

COMBUSTION CHAMBERS.—Seven straight-flow combustion chambers. Flame tubes in Nimonic 75 with fuel atomisers in front end of each tube for downstream injection. Torch igniters (Mk. 505) or high-energy igniter plugs (Mks. 506 and 510) in Nos. 3 and 7 chambers.

FUEL SYSTEM.—Single multi-plunger variable-stroke injection pump delivers fuel to burners and torch igniters (when fitted) through flow control unit, which incorporates a filter, throttle valve, shut-off cock and barometric pressure control solenoid. Operation of control unit is function of intake pressure and throttle valve pressure drop, thus determining fuel/air ratio for all engine operating conditions. Fuel pressure at burners varies from 40 lb./sq. in. (2.81 kg./cm.^{2}) at idling speed to 920 lb./sq. in. (64.6 kg./cm.^{2}) at maximum power. Automatically-progressive injection of water/methanol used to restore take-off power under high ambient temperature conditions. System inter-connected mechanically with throttle lever to ensure that it can only be used at take-off r.p.m. Fuel filter de-icing by hot air from compressor. Hot-air gate fitted to bottom engine mounting.

TURBINE.—Two-stage axial-flow turbine, the two discs coupled and bolted to a single shaft which forms direct drive to compressor. First-stage turbine disc in Jessops G18B steel, second-stage disc in S.62 stainless steel. 131 blades on first stage turbine, 103 on second-stage. All blades of Nimonic alloy, and secured on discs by "fir-tree" type serrated roots. Each turbine wheel cooled on both faces by air bled from compressor.

EXHAUST UNIT.—Airscrew thrust line co-axial with engine main shaft but exhaust unit can be either straight or have a slight inclination to suit installation. Unit comprises an outer shell which supports an inner cone on three struts enclosed in aerofoil-section fairings to reduce turbulence and straighten gas flow at nozzle. Maximum jet pipe temperature 1,103°F. (595°C.).

ACCESSORY DRIVES.—An accessory gear-box drive is taken from the main-shaft centre-coupling immediately behind compressor through a train of gears, to a housing on top of intermediate casing ; a universal coupling provides final drive to gear-box.

LUBRICATION.—Entirely self-contained. Integral oil tank (total capacity 25 pints= 14 litres) has two compartments, one for engine requirements and other for airscrew feathering. Gear pump supplies oil to all bearings and reduction-gear jets at nominal pressure of 30 lb./sq. in. (2.10 kg./cm.^{2}) and at nominal flow of 460 Imp. gallons (2,091 litres) per hour. Combined delivery from four scavenge pumps returned to tank *via* oil-cooler on top of intake casing. Pressure and scavenge pumps in single housing and driven by common shaft.

CONTROLS.—Only two cockpit controls, a throttle lever for varying power and a high-pressure cock for stopping engine. Throttle valve is interconnected with the airscrew controller and high-pressure cock is linked with airscrew feathering controls. Blades may be feathered by moving shut-off cock lever past the closed position ; depression of an unfeathering button returns blades to fine pitch. To avoid undue load when starting, a cut-out connected with the airscrew prevents engine starting system from operating unless blades are in zero pitch. Safety device prevents airscrew from going into zero pitch unless aircraft weight is on landing-gear.

MOUNTING.—Four feet are provided at 90° on the horizontal and vertical centre-lines of compressor casing, although only three need be used. Bottom foot for hot-air gate valve. No rear mounting is required, but jet pipe if used requires separate mounting in airframe.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

CANADA

BRISTOL

BRISTOL AERO ENGINES, LTD.

HEAD OFFICE AND WORKS: 10210 PIE IX BOULEVARD, MONTREAL NORTH, 12, QUEBEC.

Directors: Sir Reginald Verdon Smith (Chairman); R. J. Reynolds (President); J. A. Limoges (Vice-President and Treasurer); Air Vice-Marshal A. L. James (Vice-President and General Manager); B. A. Chalmers (Vice-President and Secretary); D. Ross McMaster.

BRISTOL AERO ENGINES (WESTERN) LTD.

HEAD OFFICE AND WORKS: VANCOUVER AIRPORT, B.C.

Directors: Sir Reginald Verdon Smith (Chairman); R. J. Reynolds (President); J. H. Holt (Vice-President and General Manager); B. A. Chalmers (Vice-President); W. R. C. Patrick; W. H. K. Edmonds.

Secretary-Treasurer: D. M. Grant.

In 1950, The Bristol Aeroplane Company of Filton, England, opened an office in Montreal and a factory in Vancouver for the repair and overhaul of aero-engines. In the following year, the company purchased Canadian Wright Ltd., which had been granted a licence pre-war to overhaul and service Bristol engines; and in 1952 a large modern aero-engine repair, overhaul and test plant was built in Montreal North.

Both Canadian companies are engaged on servicing and repair of engines for civil airlines, the R.C.A.F. and Royal Canadian Navy, the types involved including the Hercules, Merlin, Wright R-3350 Turbo Compound and R-1820 engines and complete Lancaster and North Star power-plants.

In addition, the Western company has enlarged its facilities by almost 50 per cent, to a total floor area of 60,000 sq. ft. (5,575 m.²) during 1956-57, in connection with forthcoming work on the Proteus turboprops of Britannia aircraft ordered by operators in North America.

ORENDA

ORENDA ENGINES, LIMITED.

HEAD OFFICE AND WORKS: MALTON, ONTARIO.

POSTAL ADDRESS: BOX 4015, TERMINAL "A", TORONTO.

Chairman: Crawford Gordon, Jr.

President and General Manager: W. R. McLachlan.

Vice-President—Engineering and Chief Engineer: C. A. Grinyer.

Vice-President—Manufacturing: E. K. Brownridge.

Vice-President—Sales and Service: Paul Y. Davoud.

Assistant to the President: F. L. Trethewey.

Quality Control Manager and Chief Inspector: L. E. Marchant.

Orenda Engines, Ltd., a member of A. V. Roe Canada, Ltd., and the Hawker Siddeley Group, was originally the Gas Turbine Division of the former, but was constituted as a separate company under its present name on January 1, 1955. It is the only company in Canada engaged in the full cycle of design, development and production of aero-engines.

Currently in production are the Orenda 11 turbojet engine for the Avro Aircraft CF-100 Mks. 4 and 5, and the Orenda 14 for the Canadair Sabre Mk. 6. A version of the Orenda 11 is being evaluated with simplified reheat to extend the altitude capability of the CF-100. Limited reheat is utilized to maintain the existing tail-pipe diameter and avoid major structural changes to the aeroplane. A new design of turbojet, the Iroquois, is under development.

New high altitude, combustion, aerodynamic, afterburner and blade-cooling facilities and new development test cells are among the latest additions to Orenda's total facilities, which comprise over one million square feet. These are located mainly at Malton, but the company also maintains a full-scale test establishment at Nobel, Ontario, 170 miles to the north.

THE IROQUOIS.

Design of the Iroquois, then known as the PS-13, was started in September, 1953, with the object of producing an engine capable of high performance at supersonic speeds. An official Instruction to Proceed with its development was received from the Canadian Department of Defence Production on January 13, 1954 and the first prototype engine ran for the first time on December 17 that year. Since then various special-category tests have been completed with numerous prototypes.

The Iroquois is a two-spool axial-flow turbojet, fitted with a short afterburner produced by the American Marquardt company. It has multi-stage low-pressure and high-pressure compressors, an annular combustion chamber and independent high-pressure and low-pressure turbines. Its air mass flow has been reported as about 335 lb./sec. (152 kg./sec.), with a pressure ratio of about 8 : 1.

Great emphasis has been placed on simplicity and low weight. The Iroquois with reheat contains fewer parts than the much lower-powered Orenda turbojet without reheat, and 20% of the finished weight of the engine is composed of titanium alloys. In particular, the discs, spacers and blades of the compressors are made of titanium, except for the final stages of the high-pressure spool, which are of steel. All compressor blades are precision cast. Turbine blades are cast from Inconel 700 and 713.

A two-piece casing, in upper and lower halves, is used over the low-pressure compressor; but the casing over the high-pressure compressor is made as a single piece. Air is tapped from the compressor to de-ice the four streamlined struts inside the intake, which bear the loads of the front bearing and carry the large electric alternator. The fuel system and other accessories are housed in a tank under the engine. Two alternative fuel systems have been designed, consisting of an American system by Bendix and a Canadian system by Lucas-Rotax which includes a twin air-turbine pump of high capacity.

Initial flight testing of the Iroquois is being done inside a large nacelle built on to the side of the rear fuselage of a Boeing B-47 bomber.

The Iroquois has been chosen to power the Avro Arrow Mk. 2 twin-engined supersonic interceptor. It will also be built under licence in the United States by the Curtiss-Wright Corporation.

DIMENSIONS (approx.).—
Diameter 47 in. (1,195 mm.).
Length with short afterburner 300 in. (7,620 mm.).

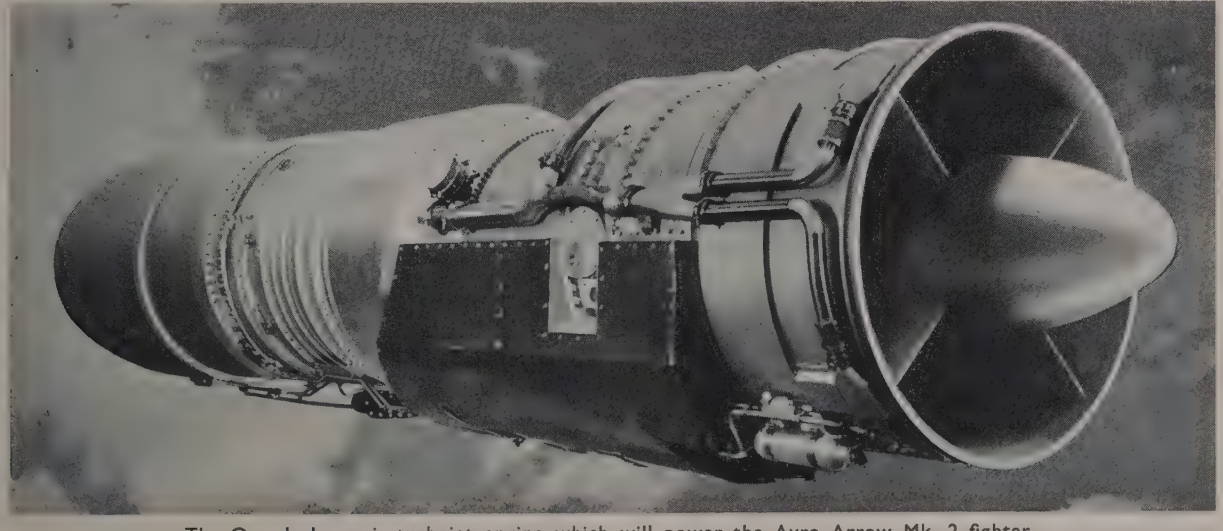
WEIGHT DRY.—
5,900 lb. (2,675 kg.).

PERFORMANCE. —
With reheat 28,000 lb. (12,700 kg.).

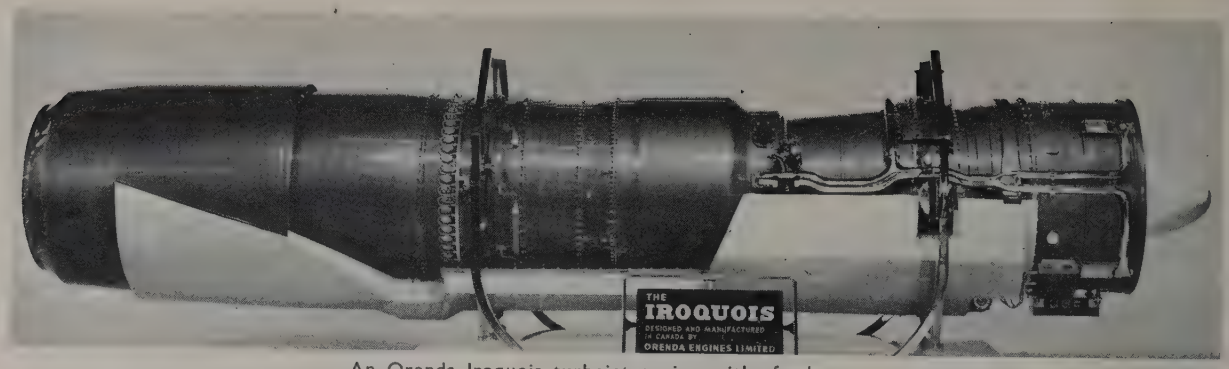
THE ORENDA.

The Orenda ran for the first time in February, 1949, and within 8½ months of the first run the prototype engine had completed 750 hours of development flying without a major rebuild or overhaul.

The Orenda engine first flew as prime mover in a North American F-86A at the



The Orenda Iroquois turbojet engine which will power the Avro Arrow Mk. 2 fighter.



An Orenda Iroquois turbojet engine with afterburner.

Edwards A.F.B., Muroc, California, in October, 1950. On June 20, 1951, the Avro Canada CF.100 two-seat long-range all-weather interceptor fighter, for which the Orenda engine was specifically designed, made its first flight powered by two Orenda engines.

The Orenda 11 and 14 are now in production. The following versions have been publicly announced :—

Orenda 1. Original design. First ran in February, 1949, thirty months after the design was initiated.

Orenda 2. First production version. Passed its type test in February, 1952. Essentially the Orenda 1 with modified suspension and reduced weight.

Orenda 3. An Orenda 1 modified for installation in a special F-86A. This was the first model to fly under its own power.

Orenda 8. Modified compressor to improve acceleration characteristics. Incorporates Bendix flow-control unit containing acceleration controller. Arrangement of accessories such that right and left-hand engines are required for the CF-100 installation. Passed type test in January, 1953.

Orenda 9. Basically a left-hand Series 8 engine with minor external modifications so that the engine is suitable for installation in either right or left-hand nacelle of CF.100 Mk. 4. Incorporates alcohol anti-icing of engine intake.

Orenda 10. Basically an Orenda 8 engine with minor external modifications for installing in Canadair Sabre Mk. 5. Incorporates Delco starter-generator in nose bullet instead of Jack & Heintz electric starter in other models. Uses aircraft oil tank instead of integral engine oil supply as on all other models. As with all the above engines the Orenda 10 is in the 6,355 lb. (2,885 kg.) static thrust category.

Orenda 11. A two-stage development of Orenda 9. Has high-energy ignition. Develops over 7,275 lb. (3,300 kg.) s.t. at 7,800 r.p.m. Type-tested in January, 1954.

Orenda 14. Similar to Orenda 11 but adapted for installation in Canadair Sabre Mk. 6. Same rating as Orenda 11. Type-tested in September, 1954.

The description which follows applies specifically to the Orenda Series 9 although the general structural description may be taken to cover all versions.

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular intake surrounding nose bullet. Intake frame houses power take-off, supports electric starter and provides for attachment of debris guard and intake fairing. Radial struts of frame carry starter leads and various other engine services. De-icing by alcohol-distributing fairing spinner. Inlet air flow 106 lb./sec. (48 kg./sec.).

COMPRESSOR.—Ten-stage axial-flow compressor made up of blade discs mounted on internal drum, stages 1-9 shrunk on ; 10th stage bolted. Pads on an annular duct at 8th stage are available for air bleed for aircraft services. Split magnesium casing.

COMBUSTION CHAMBERS. — Six interconnected straight-through chambers each with a concentrically-mounted flame tube having a burner in the front end and discharging down-stream. Lucas-Duplex III burners, one in each chamber mounted on centre casing. Interconnectors between Nos. 1 and 2 and Nos. 5 and 6 chambers each carry torch igniter atomiser and igniter plug.

FUEL SYSTEM.—Fuel delivered by two Lucas high-pressure variable-stroke pumps through Bendix TJ-52 flow control unit, which embodies the air/fuel ratio controller, and a Lucas flow distributor valve. Maximum fuel pressure 2,000 lb./sq. in. (140 kg./cm.^{2}).

FUEL.—3-GP-23A (MIL-F-5616 Grade JP-1), 3-GP-22A (MIL-F-5624A Grade JP-4) or MIL-F-5161B.

TURBINE.—Single-stage turbine consisting of an austenitic steel disc with nickel-chromium blades inserted in its periphery by "fir-tree" fixings. Centre and rear bearings and both faces of turbine disc cooled by compressor air bled from second and fifth stages and by leakage air from tenth stage peripheral seal. Gas temperatures 900°C. before and 715°C. after turbine.

JET PIPE.—Fabricated from 321 stainless steel sheet with cast steel flanges at front and rear. Bullet supported by four tubular struts which pass through four large straightener vanes. Front face of bullet double-walled with fiberglass insulation between. Outer jet-pipe casing lagged with insulation blanket.

ACCESSORY DRIVES.—From front end of compressor shaft through vertical shafts to bevel-drive gearbox above and oil pump gearbox below. Shaft from upper bevel drive operates auxiliary gear box which carries two fuel pumps and a tachometer generator. Connection provided on oil pump gearbox to drive shaft to a separate accessories gearbox mounted in the airframe.

LUBRICATION.—Dry sump type. Nichols main and auxiliary scavenge pump. Pressure oil supplied to rotor bearings, gear boxes, front bearing seal and drive-shaft flexible coupling through ring main. Used oil collects in three separate sumps. Relatively cool oil from front sump is returned directly to tank while hot oil from two rear sumps returns to tank through cooler which uses engine fuel as coolant. Capacity of integral oil tank 17.3 Imp. pints. Maximum oil temperatures 70°C. (158°F.) at ring main, 140°C . (284°F.) at central bearing scavenge. Oil specification MIL-0-6081A Grade 1010.

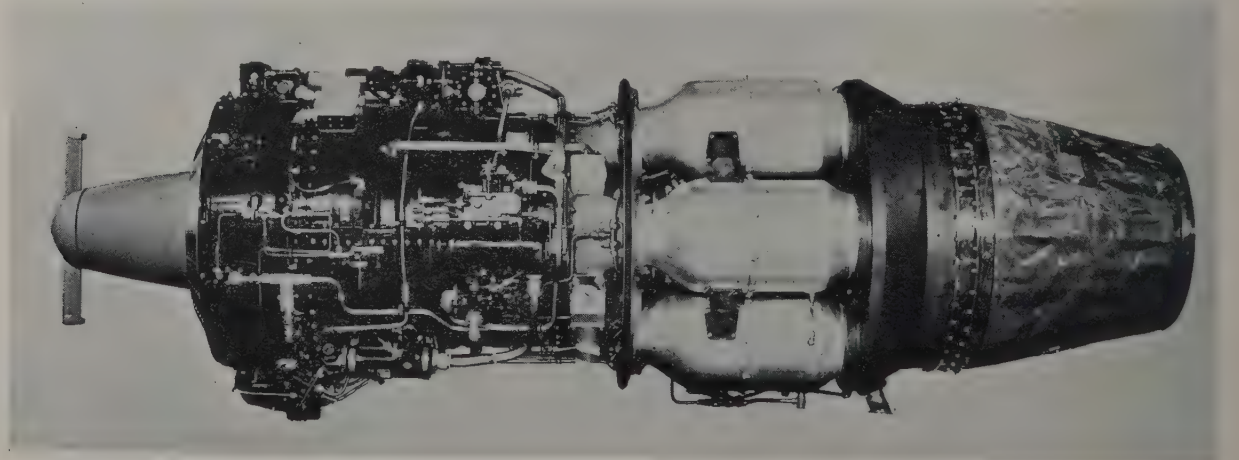
MOUNTING.—Three-point suspension with two trunnions on centre casing and an adjustable strut on backbone ahead of turbine nozzle box.

IGNITION.—Two GLA high-intensity igniter plugs and one Orenda torch igniter fed through solenoid-operated reducing valve from high-pressure fuel line.

STARTING.—Jack and Heintz D.26 28.5 volt electric starter with outside power source.

DIMENSIONS.—
Nominal diameter 42 in. (107 cm.).
Length of engine (from front face of intake screen to rear of exhaust cone) 121.5 in. (3,090 mm.).
Length overall 143.6 in. (3,647 mm.).

WEIGHTS.—
Dry 2,560 lb. (1,160 kg.).



The Orenda Series II engine (7,275 lb.=3,300 kg. s.t.), a development of the Series 9 with a two-stage turbine.

PERFORMANCE RATINGS.—
Max. rating 6,355 lb. (2,885 kg.) at 7,800 r.p.m.
Military rating 5,870 lb. (2,547 kg.) at 7,600 r.p.m.
Normal rating 5,020 lb. (2,280 kg.) at 7,250 r.p.m.

FUEL CONSUMPTIONS.—
Max. 1.119 lb./lb. s.t./hr. (1.119 kg./kg. s.t./hr.).
Military 1.100 lb./lb. s.t./hr. (1.100 kg./kg. s.t./hr.).
Normal 1.09 lb./lb. s.t./hr. (1.09 kg./kg. s.t./hr.).

OIL CONSUMPTIONS.—
Max. 2 pints/hr. (1.135 litres/hr.).
Normal 1 pint/hr. (0.5675 litres/hr.).

ROLLS-ROYCE

ROLLS-ROYCE OF CANADA, LTD.

HEAD OFFICE AND WORKS : CÔTE DE LIESSE ROAD, NEAR MONTREAL, P.Q.
General Manager : R. M. Kendall.
Works Manager : David Boyd, O.B.E.

Rolls-Royce of Canada, Ltd. was formed in 1952 to undertake the assembly and manufacture of Rolls-Royce gas-turbine engines and to supply the necessary overhaul, technical service and spare parts for Rolls-Royce products in North America.

Manufacture of the Nene 10 turbojet engine for installation in the Silver Star (T-33A) two-seater jet trainer in production for the R.C.A.F. by Canadair, Ltd. has been completed, but the manufacturer of spare parts and overhaul work are continuing in the factory.

The company is also overhauling Westinghouse J34 turbojets for the Royal Canadian Navy.

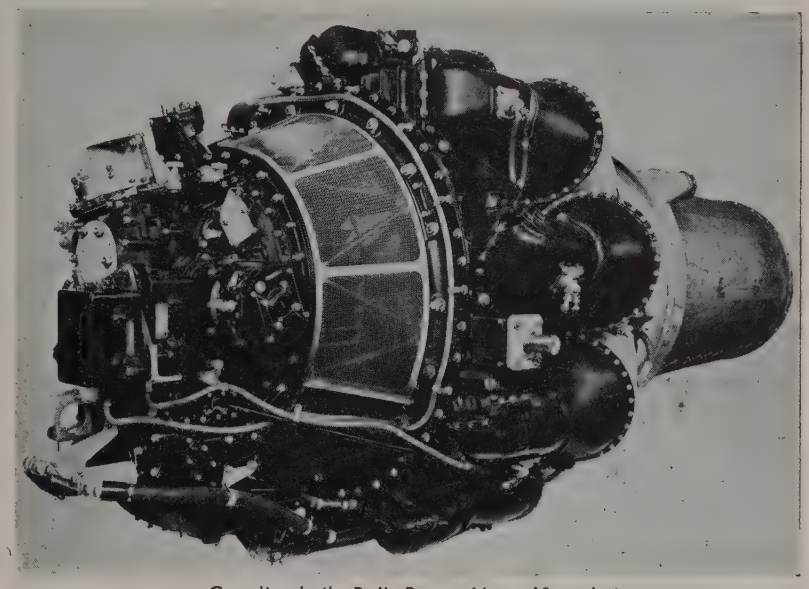
Technical service and spare parts for the Merlin and Dart engines of Trans-Canada Air Lines are being provided from Montreal, and similar service is being provided for the Merlin and Nene engines in the Royal Canadian Air Force and the Dart engines which power the Viscounts in service with operators in the United States. This service will be extended eventually to cover the Dart engines of Fairchild F-27 airliners and the Tyne engines of Trans-Canada Air Lines' Vickers Vanguards.

Dart engine overhaul facilities will be provided at Montreal from the beginning of 1958.

THE ROLLS-ROYCE NENE 10.

Although basically similar to the standard Rolls-Royce Nene R.N.2 Mk. 10 as manufactured by the parent company in Great Britain, the Canadian-built Nene 10 incorporates a number of modifications to suit it for installation in the Canadair Silver Star jet-trainer. The main differences are as follows.

COMPRESSOR.—Rotating guide vanes are of steel machined all over. High-pressure air is drawn from three tappings on the rear casing to cool face of turbine disc. Pressure air for cabin heating is taken from tapping on front casing.



Canadian-built Rolls-Royce Nene 10 turbojet.

COMBUSTION CHAMBERS. — High-energy igniters in Nos. 1 and 5 chambers.

FUEL SYSTEM.—Twin pumps of oscillating multi-plunger type, with built-in overspeed governors, draw fuel through aircraft-mounted filter, via a fuel collector mounted under wheelcase, and deliver to burners via throttle valve and pressurising valve which also accommodates the high-pressure shut-off cock. Barometric pressure control coupled into servo system in high-pressure pumps to vary pump delivery according to altitude. Acceleration control unit retards fuel flow to match air/fuel ratio to air mass flow during acceleration periods. Pilot-operated solenoid-type isolation valve ensures full output from one pump in event of failure of other or of the barometric pressure control.

FUEL.—Grade 3-GP-22A. Emergency operation on gasoline.

TURBINE.—Turbine blades in Nimonic 80A nickel-chrome alloy. Gas temperature before turbine 840°C., after turbine 700°C.

JET PIPE.—Consists of jet pipe and propelling nozzle. Four thermo-couples fitted. Jet pipe temperature 700°C. approximately. Exhaust cone, fitted between engine and jet pipe, is lagged with heat-reflecting sandwich-type blanket.

ACCESSORY DRIVES.—Auxiliary gearbox, mounted on front facing of wheelcase and driven from the impeller front shaft via the wheelcase gear train, provides drives for generator and hydraulic pump. Centrifugal oil breather is also accommodated in auxiliary gearbox. Wheelcase provides drives for two high-pressure fuel pumps, tachometer drive and oil pumps. 24-volt electric starter motor mounted on port side of wheelcase and connected through ratchet and pawl-type engaging mechanism to impeller front shaft.

LUBRICATION.—Capacity of sump approximately 12 Imp. pints (6.8 litres).

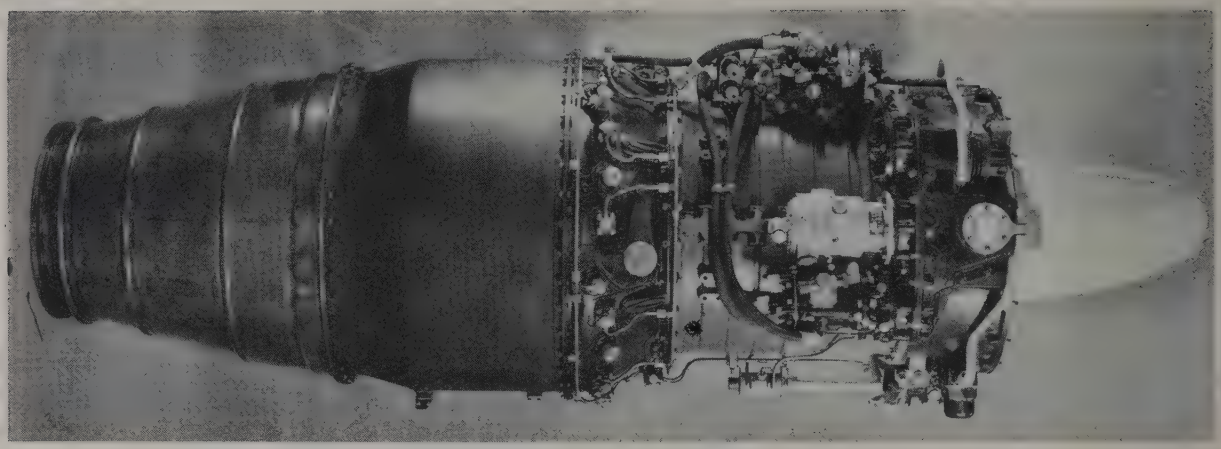
OIL GRADE.—Specification 3-GP-901, Grade 1010.

MOUNTINGS.—Attachment points on port and starboard sides of compressor rear casing by bolted-on trunnions, with a steady mounting at the bottom.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—As for Rolls-Royce Nene R.N.2 Mk. 10.

FRANCE

DASSAULT



The Dassault M.D. 30 Viper turbojet engine (745 kg.=1,640 lb. s.t. at sea level).

GÉNÉRALE AÉRONAUTIQUE MARCEL DASSAULT.

HEAD OFFICE: 78, QUAI CARNOT, SAINT-CLOUD (SEINE-ET-OISE).

WORKS: SAINT CLOUD (SEINE).

Director-General: M. B. C. Vallières.

In 1953 Dassault acquired the licence to build the Armstrong Siddeley "long-life" Viper turbojet engine in France. The licence-built engine carries the designation M.D. 30 Viper.

Dassault has undertaken considerable engineering work in adapting the Viper to certain specific requirements, including the development of an afterburner.

The first application of M.D. 30 to a French airframe was in the S.O. 9000 Trident turbojet/rocket powered research monoplane in which two Vipers are now installed at the wing tips. In this installation the two engines are "handed" with the accessories mounted on the inboard sides. With the power of its wing-tip-mounted Vipers only the Trident has exceeded Mach 1 in a shallow dive. With rocket power only it has exceeded Mach 1 in a climb. Vipers are also installed in the S.O. 9050 interceptor development of the Trident. Two M.D. 30 Vipers fitted with afterburners also power the Dassault M.D. 550 Mirage I delta-wing fighter.

The latest development of the company is the R.7 turbojet, details of which follow.

THE DASSAULT M.D. 30 VIPER.

The M.D. 30 turbojet has a seven-stage axial-flow compressor, an annular combustion chamber and a single-stage turbine. The compression ratio is 3.5 : 1 and the mass air-flow at 13,400 r.p.m. at sea level is 14 kg. (30.8 lb.) per second. A general description of the Viper will be found under "Armstrong Siddeley" (Great Britain).

DIMENSIONS.—
Diameter 580 mm. (23 in.).
Length (without afterburner) 1,680 mm. (66 in.).
Length (with afterburner) 3,200 mm. (126 in.).

WEIGHT DRY.—
Without afterburner 235 kg. (517 lb.).
With afterburner 315 kg. (693 lb.).

RATINGS.—
Take-off, without afterburner 745 kg. (1,640 lb.) s.t. at 13,400 r.p.m.
Take-off, with afterburner 1,000 kg. (2,200 lb.) s.t. at 13,400 r.p.m.

CONSUMPTIONS.—
Fuel (without afterburner) 1.09 kg./kg. s.t./hr. (1.09 lb./lb. s.t./hr.).
Fuel (with afterburner) 2.20 kg./kg. s.t./hr. (2.20 lb./lb. s.t./hr.).

THE DASSAULT R.7.

The Dassault R.7 is virtually a 1.3 : 1 scaled-up version of the Armstrong Siddeley Viper ASV.10 turbojet. It first ran in December 1956, and a version with a 32% augmentation afterburner is also under development.

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular surrounding nose bullet. Inlet air flow 25.4 kg./sec. (55 lb./sec.).

COMPRESSOR.—Seven-stage axial flow. Steel stator blades are dove-tailed in grooves in outer casing. Rotor blades, of which first row are steel and remainder aluminium, secured in peripheries of discs, first row by fir-tree serrations, remainder by riveting. Discs splined to steel shaft, which is carried on front twin ball-bearing and rear roller bearing. Compression ratio 3.8 : 1. Mass air flow 25.4 kg./sec. (55 lb./sec.).

COMBUSTION CHAMBER.—Single annular type, mainly of Nimonic 75. Vaporiser type burners. Two high-energy igniters.

FUEL SYSTEM.—Armstrong Siddeley type. Maximum fuel pressure 25.3 kg./cm.^{2} (360 lb./sq. in.).

FUEL GRADE.—Kerosene AIR 3405 or JP4.

NOZZLE GUIDE VANES.—Single row of aerofoil type blades of Jessop G.39 steel.

TURBINE.—Single-stage axial flow. Disc of Rex 448 austenitic steel with blades of Nimonic 90 secured in periphery by fir-tree serrations. Turbine disc secured to shaft by Hirth coupling.

JET PIPE.—Fixed type. Cone and pipe of stainless steel sheet.

ACCESSORY DRIVES.—On side and front intake.

AFTERBURNER.—Details not available. Provides 32 per cent. increase in thrust.

LUBRICATION.—Circulation on front bearing, "total loss" on centre and rear bearing. Normal supply pressure 2.60 kg./cm.^{2} (37 lb./sq. in.).

OIL SPECIFICATION.—DERD. 2487.

MOUNTING.—Two trunnions at mid-length of engine and steady point on turbine flange.

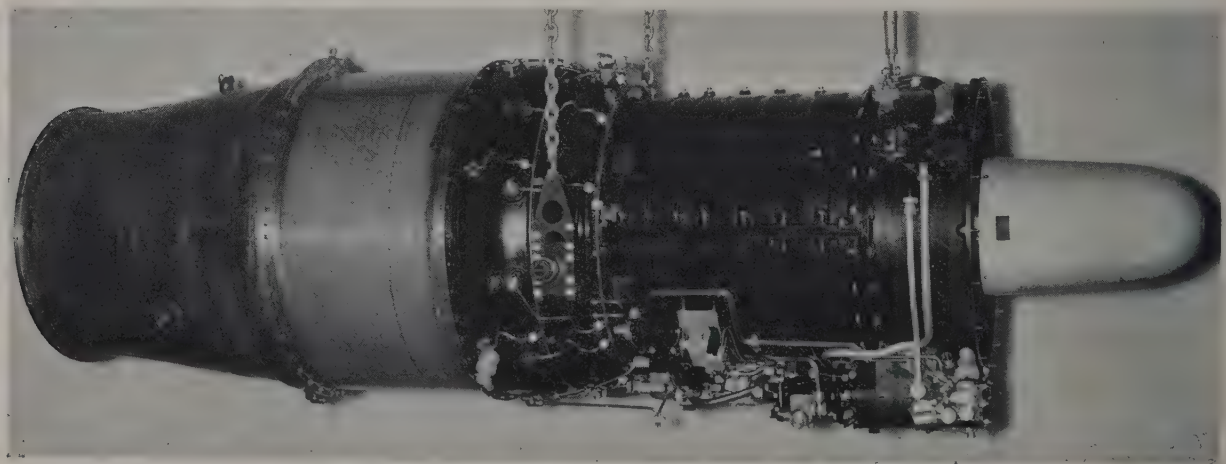
STARTING.—Electric, or by supply of compressed air on turbine blades.

DIMENSIONS.—
Diameter over turbine casing flange 69.2 cm. (27.24 in.).
Length from front face of intake to rear face of exhaust cone 200 cm. (78.8 in.).

WEIGHT.
Less electric starter 354 kg. (780 lb.).

PERFORMANCE RATING (without afterburner.—
Max. take-off 1,400 kg. (3,100 lb.) at 11,800 r.p.m.

FUEL CONSUMPTION.—
At max. static 1.10 kg./kg. s.t./hr. (1.10 lb./lb. s.t./hr.).



The Dassault R.7 turbojet engine (1,400 kg.=3,100 lb. s.t.).

HISPANO-SUIZA

SOCIÉTÉ D'EXPLOITATION DES MATÉRIELS HISPANO-SUIZA.

HEAD OFFICE AND WORKS: RUE DU CAPITAINE GUYNEMER, BOIS-COLOMBES (SEINE).

The Hispano-Suiza company entered the turbojet field by acquiring the licence to build the Rolls-Royce Nene, Tay and, later, Avon engines.

The first production engine was the Nene for installation in the Sud-Est Mistral and the Dassault Ouragan. It was followed by the Tay, which powers the Dassault Mystère II and Mystère IV. A Tay-engined Mystère II was the first French aircraft to exceed the speed of sound.

The Verdon, developed from the Tay in the same way that the Tay was evolved from the Nene, powers the Mystère IVA.

The Hispano Avon of RA.7 rating is installed in the Super Mystère IVB.1 prototype, and civil engines of RA.16 rating power the Sud-Est S.E. 210 Caravelle.

Hispano-Suiza has also undertaken considerable development work in both engines and afterburners. To further this work, Hispano have signed an agreement with Turbomeca under which the two companies established on April 23, 1956, a joint organisation named Compagnie Générale des Turbo-machines (C.G.T.M.) for technical co-operation in all fields of gas-turbine research and development.

THE HISPANO-SUIZA R.804.

The R.804 is a small axial-flow turbojet engine which has been developed from the earlier R.800 turbojet, described in previous editions of this work. It was intended to meet an official requirement for a power-plant suitable for lightweight fighter aircraft and is suitable for speeds up to Mach 1.8.

On March 23, 1957, the R.804 completed successfully a 150-hour endurance test at its design rating of 1,500 kg. (3,306 lb.) s.t. This is expected to be increased by 35% with afterburner.

TYPE.—Axial-flow turbojet.

COMPRESSOR.—Seven-stage axial type. Compression ratio 4.8 : 1. Air mass flow 26 kg./sec. (57.3 lb./sec.).

COMBUSTION CHAMBER.—Annular type with ten Duplex fuel burners.

NOZZLE GUIDE VANES.—Hollow steel guide vanes with air-cooling.

TURBINE.—Single-stage turbine with blades machined from Nimonic 80A alloy. Blade roots and both sides of turbine disc cooled by air bled from compressor.

ACCESSORY DRIVES.—Gearbox integrated in engine operates accessories of the high-pressure fuel system and lubrication system, and two upper and one lateral power take-off for accessory drives.

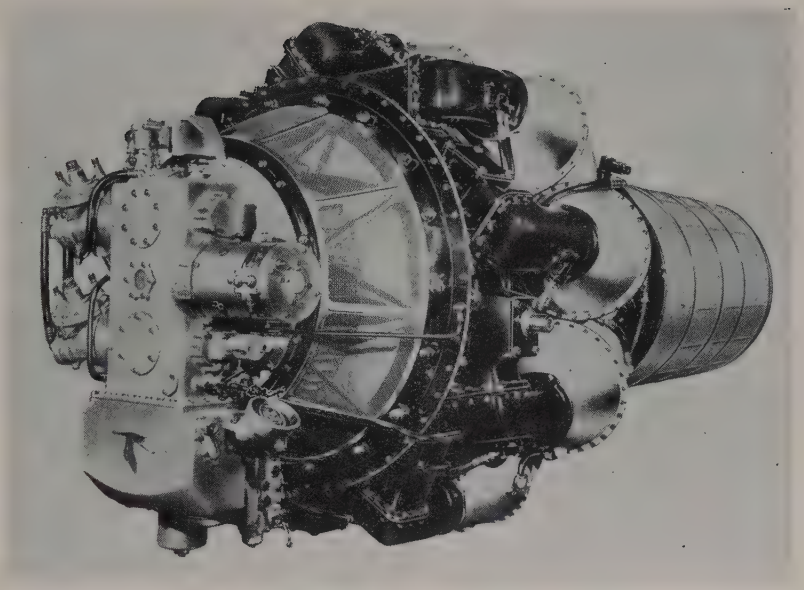
STARTING.—Electric starter.

DIMENSIONS.—
Length without jet-pipe and propelling nozzle 2,154 mm. (84.8 in.).
Diameter 690 mm. (27.2 in.).

WEIGHT.—
Weight without starter and jet-pipe 308 kg. (679 lb.).

PERFORMANCE.—
Max. rating without afterburner 1,500 kg. (3,306 lb.) s.t. at 12,000 r.p.m.

CONSUMPTION.—
Fuel at 1,500 kg. (3,306 lb.) s.t. 1.068 kg./kg. s.t./hr. (1.068 lb./lb. s.t./hr.).



The Hispano-Suiza Nene 105 turbojet engine.

THE HISPANO-SUIZA NENE.

The Hispano-Suiza Nene of which more than 1,250 were built under a Rolls-Royce licence, exists in the following versions :—

Nene 102. Substantially similar to the Rolls-Royce Nene 102 but has an aluminium-alloy compressor casing. Weight 860 kg. (1,760 lb.).

Nene 104. Similar to 102 but with magnesium alloy compressor casing. Coil ignition. Powers the S.E. Mistral.

Nene 104 BR. Nene 104 fitted with Hispano-Suiza R401G afterburner.

Nene 105. Powers the Dassault M.D. 450 Ouragan.

Nene 105 AR. Nene 105 fitted with Hispano-Suiza R401G afterburner.

A full description of the Hispano-Suiza Nene has appeared in earlier editions of "All the World's Aircraft."

DIMENSIONS (Nene 105).—
Max. diameter 1,258 mm. (49.5 in.).
Length to exhaust cone flange 2,440 mm. (96 in.).
Frontal area 1.24 m.² (13.3 sq. ft.).

WEIGHT (Nene 105).
730 kg. (1,606 lb.).

WEIGHT (Nene 104 BR and 105 AR).—
With afterburner and equipment 1,025 kg. (2,650 lb.).

POWER RATINGS (Nene 105).—
Max. take-off 2,315 kg. (5,100 lb.) s.t. at 12,500 r.p.m. at sea level.
Max. continuous 2,080 kg. (4,620 lb.) s.t. at 12,200 r.p.m. at sea level.
Max. cruise 1,850 kg. (4,050 lb.) s.t. at 11,800 r.p.m.

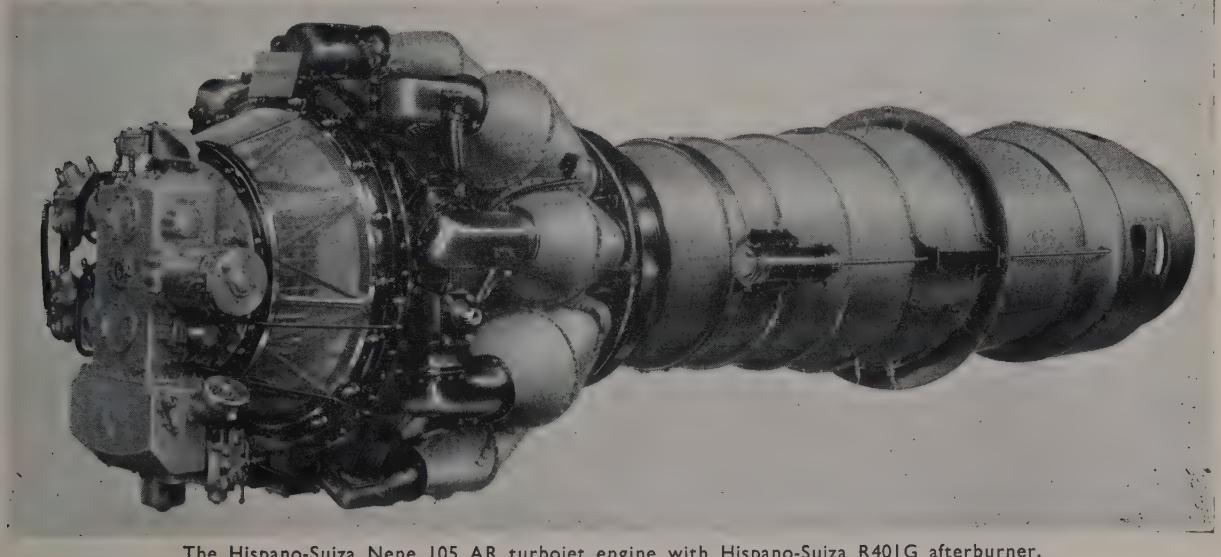
POWER RATING (Nene 104 BR and 105 AR).—
Static thrust with afterburner (corrected) 3,080 kg. (6,800 lb.) at 12,500 r.p.m. at sea level.

CONSUMPTIONS (Nene 105).—
Fuel (cruising) 1 kg./kg. s.t./hr. (1 lb./lb. s.t./hr.).
Oil (cruising) 0.20 kg./hr. (0.44 lb./hr.).

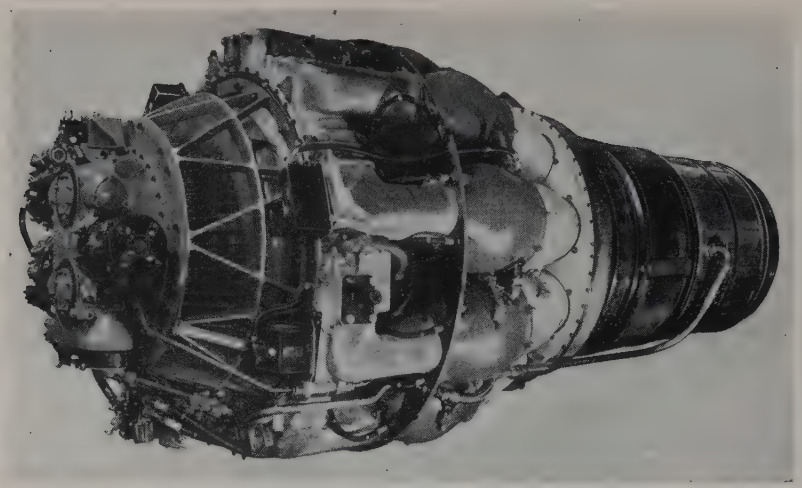
FUEL CONSUMPTION (Nene 104 BR and 105 AR).—
Max. at sea level 2.05 kg./kg. s.t./hr. (2.05 lb./lb. s.t./hr.).

THE HISPANO-SUIZA VERDON 350

The Verdon 350 is a development of the Tay 250, the principal modifications being generally similar to those



The Hispano-Suiza Nene 105 AR turbojet engine with Hispano-Suiza R401G afterburner.



The Hispano-Suiza Verdon 350 turbojet engine.

employed to evolve the Tay from the Nene. These include internal changes to permit a greater flow of air through the engine; an increase in turbine speed: and a slight increase in the permissible gas temperature after the turbine. In other respects, the Verdon uses the greatest possible number of Tay components and is installationally interchangeable with the Tay.

The Verdon was first flown in a Dassault Mystère on August 3, 1953 and over 550 had been delivered by July, 1957.

DIMENSIONS.—
Max. diameter 1.27 m. (50 in.).
Length 2.62 m. (103.2 in.).
Frontal area 1.26 m.² (13.6 sq. ft.).

WEIGHT.—
Dry 935 kg. (2,057 lb.).

PERFORMANCE RATINGS.—
Take-off 3,500 kg. (7,700 lb.) s.t. at 11,100 r.p.m. at sea level.
Max. continuous 2,800 kg. (6,160 lb.) s.t. at 10,500 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (max.) 1.1 kg./kg. s.t./hr. (1.1 lb./lb. s.t./hr.).
Oil 0.25 kg./hr. (0.55 lb./hr.).

NORD

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD

HEAD OFFICE: 12 *bis* AVENUE BOSQUET, PARIS (7E).

DEVELOPMENT CENTRE: CHATILLON-SOUS-BAGNEUX (SEINE).

The main activity of the Nord Propulsion Division (formerly Arsenal de l'Aéronautique and then S.F.E.C. M.A.S.) is concentrated on the development of ramjets and afterburners. After several years of research ramjets have been fitted and tested successfully in missiles and experimental aircraft.

Details of the ARS.600 ramjet are given below. The ST.450 experimental ramjet test vehicle is described in the "Missiles" section of this Annual.

The Nord Company has also developed afterburner systems with fixed and variable-area nozzles. These have been fitted to Turbomeca turbojet engines.

THE NORD ARS. 600 RAMJET.

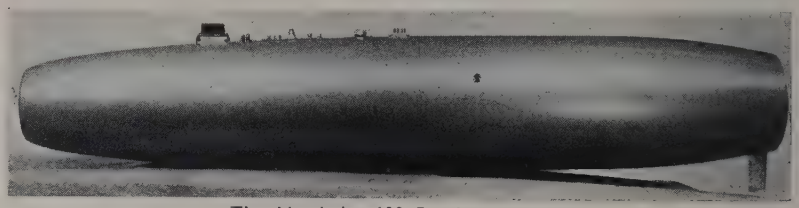
The ARS.600 is a subsonic ramjet which has been flight tested on specially-modified Gloster Meteor and English Electric Canberra aircraft.

DIMENSIONS.—
Length 3,250 mm. (127.9 in.).
Diameter 600 mm. (23.6 in.).

WEIGHTS*.—
72 kg. (158.4 lb.).

PERFORMANCE.—
†Net thrust at S/L. at 1,000 km.h. (621 m.p.h.) 500 kg. (1,100 lb.).
†Net thrust at 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 120 kg. (264 lb.).

FUEL CONSUMPTION.—
At sea level at 1,000 km.h. (621 m.p.h.) 0.80 kg./sec. (1.76 lb./sec.).
At 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 0.19 kg./sec. (0.42 lb./sec.).



The Nord Ars.600 Ramjet.

*Weight given includes diffuser, combustion chamber, flameholder, injection grid with fuel injectors, and ramjet nozzle.

†Net thrust is the force transmitted to the attachment points.

THE NORD ST.450 RAMJET.

The ST.450 is a supersonic ramjet engine which is being test-fired in the form of a tail-first integrally-powered test vehicle. When the fuel is exhausted, the ramjet is separated from the body of the vehicle by explosive bolts and is recovered by parachute.

Intended for missile applications, the ST.450 is a circular-section ramjet, with concentric centre-body housing the fuel tank, control and test gear and parachute. Two small foreplanes are mounted on the nose. Cruciform wings are mounted on the detachable rear body, which constitutes the integral combustion chamber. The ST.450 is suitable for speeds up to Mach 3.2 at heights over 23,000 m. (75,500 ft.).

DIMENSIONS.—
Length with detachable rear body 4,700 mm. (185 in.).
Diameter 450 mm. (17.72 in.).

LAUNCHING WEIGHT.—
Excluding boosters 175-225 kg. (385-496 lb.).

SEPR

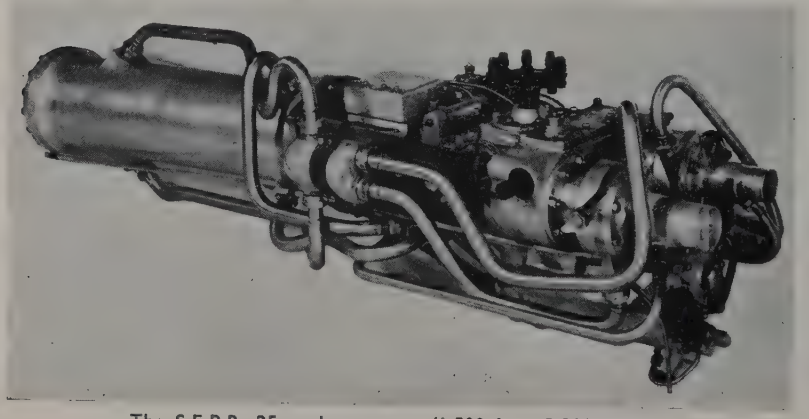
SOCIÉTÉ D'ÉTUDE DE LA PROPULSION PAR RÉACTION.

HEAD OFFICE: 37, RUE DES ACACIAS, PARIS (17E).

WORKS: ARGENTEUIL, ISTRES, VILLAROCHE AND VILLEJUIF.

President: Georges Glasser.
Director General: Jean Volpert.
Assistant Director General and Technical Director: Fernand Florio.

The Société d'Etude de la Propulsion par Réaction was formed in 1944 to design and develop rocket motors for piloted aircraft and guided weapons. Initially, it based its work on German wartime research; but has since made great advances in original design and construction and is now the largest manufacturer of rocket-engines on the Continent of Europe. It employs some 950 persons.



The S.E.P.R. 25 rocket motor (1,500 kg.=3,300 lb. s.t.).

S.E.P.R. liquid-propellent rocket-engines all use nitric acid as oxidant. The first was the S.E.P.R. 25 and one of these engines equipped the S.O. 6025 Espadon which made the first flight by a French rocket-powered aircraft on June 10, 1952. Since then, S.E.P.R. engines have been fitted in the S.O. 9000 Trident I, S.O. 9050 Trident II, S.E. 212 Durandal, experimental versions of the Dassault Mystère IV and other types. The company also produces a wide range of solid-propellent and liquid-propellent rockets as primary power plants and boosters for guided missiles.

THE S.E.P.R. 25 AND 251.

First S.E.P.R. rocket-engine to be test flown, the S.E.P.R. 25 was an experimental unit with a single combustion chamber. It was not self-contained, its pumps being driven by a shaft from the

turbojet of the S.O. 6025 Espadon aircraft in which it was fitted. The S.E.P.R. 251, fitted to the S.O. 6026 Espadon, was similar.

TYPE.—Liquid bi-propellent rocket.

PUMPS.—Two centrifugal pumps. Oxidant pump discharge pressure 50 kg./cm.^{2} (711.16 lb./sq. in.). Fuel pump discharge pressure 35 kg./cm.^{2} (497.81 lb./sq. in.).

COMBUSTION CHAMBER.—Single combustion chamber of light alloy, consisting of two concentric shells between which the nitric acid oxidant is circulated as a coolant.

PROPELLENTS.—Nitric acid and Furaline. Mixture ratio 2.4 : 1.

PUMP DRIVE.—Drive from engine transmitted to pumps by a gear set, through a multiple disc clutch which is operated hydraulically. Oil for hydraulic jack provided by gear pumps in oil sump.

CYCLE OF OPERATION.—While the rocket-engine is not in use, the drive shaft from the turbojet drives only the oil pumps. When the pilot operates the firing switch built into the throttle lever in the cockpit, this opens the tank valves and actuates the hydraulic jack to engage the clutch. The clutch drives the propellent pumps and, when their discharge pressure reaches a minimum rated value, a pressure switch operates the distributor valves which admit the propellents into the combustion chamber.

DIMENSIONS.—
Length 1,510 mm. (60 in.).
Width 515 mm. (20 in.).
Height 435 mm. (17 in.).

WEIGHT.—
Without accessories 90 kg. (198 lb.).
With accessories 111 kg. (245 lb.).

PERFORMANCE.—
Static thrust 1,500 kg. (3,300 lb.).

CONSUMPTION.—
At S/L 0.0051 kg./kg. s.t./sec. (0.0051 lb./lb. s.t./sec.).
At 12,000 m. (39,370 ft.) 0.0046 kg./kg. s.t./sec. (0.0046 lb./lb. s.t./sec.).

THE S.E.P.R. 481.

First self-contained S.E.P.R. rocket-engine, this unit was developed for the S.O. 9000 Trident I aircraft and consisted of a turbopump supplying three chambers of the type fitted to the earlier S.E.P.R. 25 engine, together with a complete control system. Its great length results from the fact that the airframe designers asked that the turbopump should be located near the wing trailing edge and the combustion chambers at the tail.

Engines of this type made 1,100 ground runs and 120 flights in the Trident in 2½ years without any serious failure, enabling the aircraft to exceed its design speed of Mach 1.6.

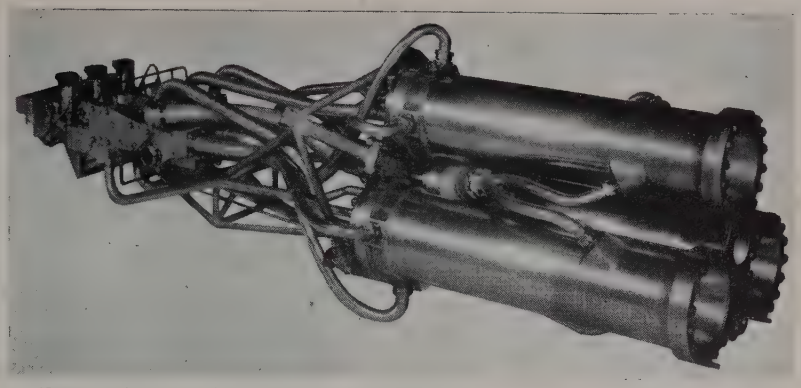
TYPE.—Liquid bi-propellent Rocket.

PUMPS.—Two main pumps and three auxiliary pumps, all of the centrifugal type.

TURBINE.—Single-stage impulse turbine fed by six injector nozzles located around inlet housing.

GAS GENERATOR.—Similar to combustion chambers, but cooled externally by water circulation and internally by water injection.

COMBUSTION CHAMBERS.—Three similar chambers of light alloy, each consisting of two concentric shells between which the nitric acid regenerative coolant is circulated. One propellent distributor feeds the three chambers independently.



The combustion chambers of the S.E.P.R. 481 (4,800 kg.=10,600 lb. s.t.).

PROPELLENTS.—Nitric acid and furaline, with methanol alcohol-water mixture for gas generator.

CYCLE OF OPERATION.—The starting switch opens the water tank valve by means of an actuator and energises an electric starter which begins to drive the three auxiliary pumps. Pressure delivered by the auxiliary water pump, when it reaches its rated value, opens the oxidant and fuel tank valves, and the propellents are fed to the gas generator by the auxiliary pumps. The generator feeds the turbine which, in turn, drives the main propellent pumps. As soon as the turbine reaches half its rated speed, it begins to drive the auxiliary pumps also and power supply to the electric starter is cut off. The propellents flow in a closed circuit until the discharge pressure of the pumps reaches its minimum rated value. Then the distributor valves of the combustion chambers open, admitting the propellents, and the chambers fire. Either one, two or all three chambers can be selected to fire by the pilot, as desired.

DIMENSIONS.—
Length 2,661 mm. (104.6 in.).
Width 615 mm. (24.2 in.).
Height 780 mm. (34.8 in.).

WEIGHT.—
Without tanks 250 kg. (551 lb.).

PERFORMANCE.—
Normal static thrust per chamber at S/L 1,500 kg. (3,300 lb.).
Max. static thrust at S/L (all chambers firing) 4,800 kg. (10,600 lb.).
Max. static thrust at 12,230 m. (40,100 ft.) (all chambers firing) 5,200 kg. (11,600 lb.).

CONSUMPTION.—
At S/L 0.00525-0,00535 kg./kg. s.t./sec. (0.00525-0.00535 lb./lb. s.t./sec.).
At 12,000 m. (39,370 ft.) 0.0048-0.0049 kg./kg. s.t./sec. (0.0048-0.0049 lb./lb. s.t./sec.).

THE S.E.P.R. 631.

Basically similar to the S.E.P.R. 481, but generally cleaned up and with only two combustion chambers, this engine is fitted to the S.O. 9050 Trident II. It develops a maximum S/L power of 3,000 kg. (6,600 lb.) s.t. with both chambers firing.

THE S.E.P.R. 65.

Fitted to the S.E. 212 Durandal, this rocket-engine has only a single small combustion chamber and gives a S/L static thrust of 825 kg. (1,819 lb.). It is used in the form of a self-contained pack, attached under the aircraft's fuselage.

THE S.E.P.R. 66.

This is a development of the S.E.P.R. 481, but is considerably neater in layout and is assembled on a truss beam for installation as a single self-contained unit. It has only one of the standard-type combustion chambers and has been designed for installation in the Dassault Mystère IV fighter.

Its main components and cycle of operation are similar to those of the S.E.P.R. 481. Mixture ratio of the nitric acid and furaline propellents is 2.7 : 1.

DIMENSIONS.—
Length 2,800 mm. (110 in.).
Width 750 mm. (29.6 in.).
Height 360 mm. (14.2 in.).

WEIGHT.—
Without tanks 150 kg. (331 lb.).

PERFORMANCE.—
Static thrust at S/L 1,500 kg. (3,300 lb.).

THE S.E.P.R. 78.

This is an assisted take-off solid-fuel rocket which is used as a booster on drone target missiles. It gives a thrust of 1,150 kg. (2,550 lb.) for two seconds.

THE S.E.P.R. 5053.

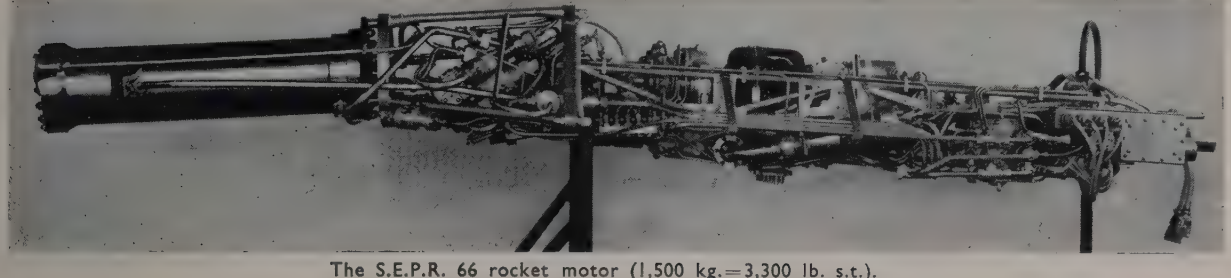
A booster for a surface-to-air anti-aircraft missile, this solid-fuel rocket gives 7,800 kg. (17,000 lb.) s.t. for four seconds.

THE S.E.P.R. 5054.

Another of the range of solid-propellent rockets now being produced by S.E.P.R., the Model 5054 gives 15,800 kg. (35,000 lb.) s.t. for 3.5 seconds. It is used as the first-stage booster for a surface-to-air guided weapon.

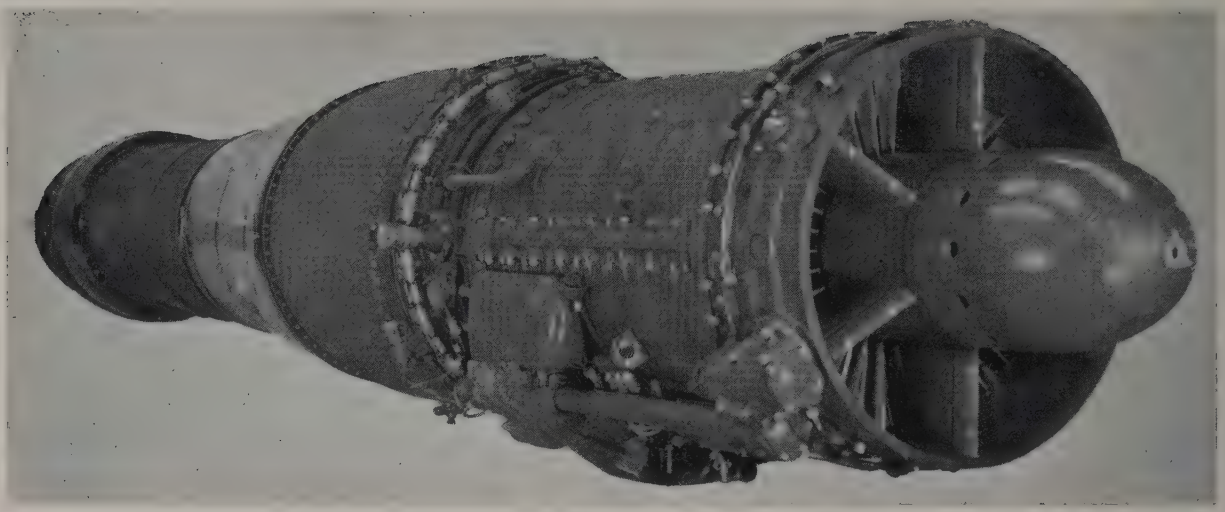
THE S.E.P.R. 732.

Most powerful S.E.P.R. solid-propellent rocket motor yet announced, this unit produces a static thrust of 20,200 kg. (44,500 lb.) for 4.5 seconds. It is a booster for large surface-to-air missiles.



The S.E.P.R. 66 rocket motor (1,500 kg.=3,300 lb. s.t.).

SNECMA



The SNECMA Atar 8 turbojet engine (4,400 kg.=9,700 lb. s.t.).

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION (SNECMA).

HEAD OFFICE: 150 BOULEVARD HAUSSMANN, PARIS (VIIIe)

WORKS: PARIS (BOULEVARD KELLERMANN), BILLANCOURT (SEINE), VILLAROCHE (SEINE-ET-MARNE), SURESNES (SEINE) AND GENNEVILLIERS (SEINE).

President and Director-General: Henri Desbruères.

Administrative Director: M. Depallens.

Technical Director: H. Oestrich.

Director-Controller: Marcel Richer.

Commercial Director: André Esperet.

Director of External Relations: Maurice Roudil.

Director of Atomic Division: Raymond Marchal.

Personnel Manager: M. Dugue MacCarthy.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation (SNECMA) is devoting the major part of its activities to the development and series production of gas-turbine engines.

Manufacture and repair of turbojet engines is centred at the Kellermann works, and of internal combustion engines at the Billancourt works. Ground and flight testing are done at Villaroche. The Gennevilliers works is engaged on forging and smelting. Prototypes are manufactured at the Suresnes works, which is also the research centre for the company.

All the S.O. 4050 Vautour, Dassault M.D. 452 Mystère II and Dassault Super Mystère IV B-2 aircraft now in production for the French Air Force are powered by SNECMA Atar engines. So are several of the latest prototypes and development aircraft, including the S.E. 5000 Baroudeur, Dassault Mirage III and Etendard IV, S.E. 212 Durandal, Nord 1405 Gerfaut II and Nord 1500 Griffon. The Leduc 0.22 also has an Atar as an auxiliary engine.

The latest SNECMA turbojets are the Atar 8 and 9, of which pre-production series are being built, and "all-steel" variants which will develop at least 6,000 kg. (13,225 lb.) s.t. and will power aircraft of high supersonic performance which are now under development.

SNECMA is also working on equipment to improve the efficiency and versatility of its turbojets, including reheat, variable-area nozzles and jet-reversal for braking purposes.

Licences to manufacture the SNECMA cascade thrust reversal system have been acquired by the Aerojet-General Corporation in the United States and the Bristol Aeroplane Company in England.

SNECMA are also studying methods of controlling aircraft directionally at low speeds, when normal aerodynamic controls would be ineffective, by deviating the thrust of a turbojet engine. One technique is to vary the area of the jet exhaust by impinging on it at a predetermined angle a powerful auxiliary air jet; this dispenses with the need for moving components in contact with the hot gases. These experiments form part of the company's "Flying Atar" research programme of which a description appears under "SNECMA" in the French pages of the "Aircraft" section of this volume.

In addition, SNECMA has acquired European rights in Professor von Zborowski's patents for the annular wing coleopter type of aircraft.

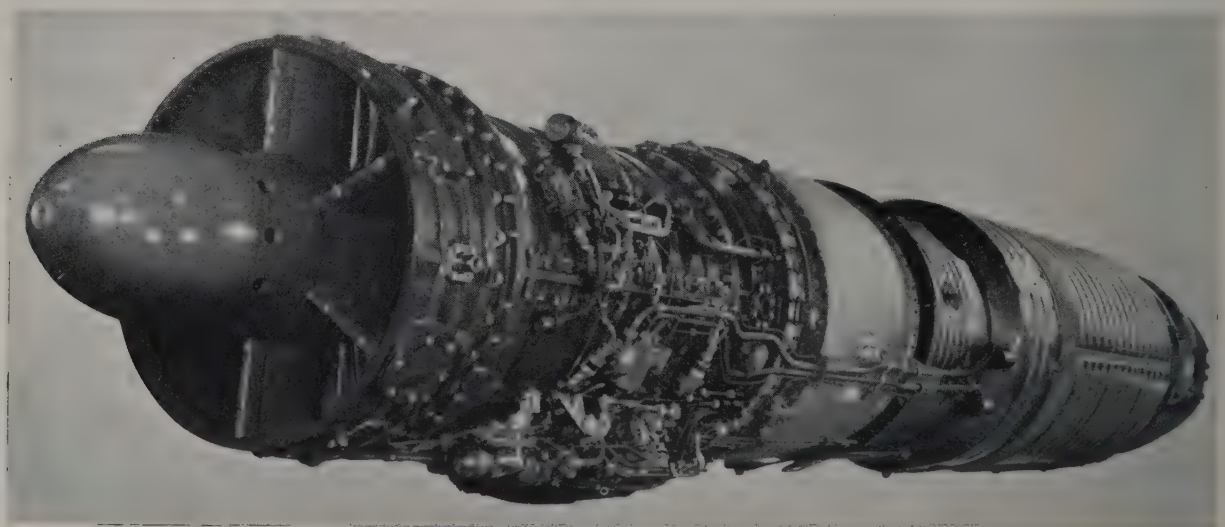
Its Atomic Division was formed in 1956 to study problems concerning the application of nuclear energy to the design of gas-turbine engines.

SNECMA continues its development in the field of pulsating jet units and brief details of the Escopette and Ecrevisse units are given hereafter.

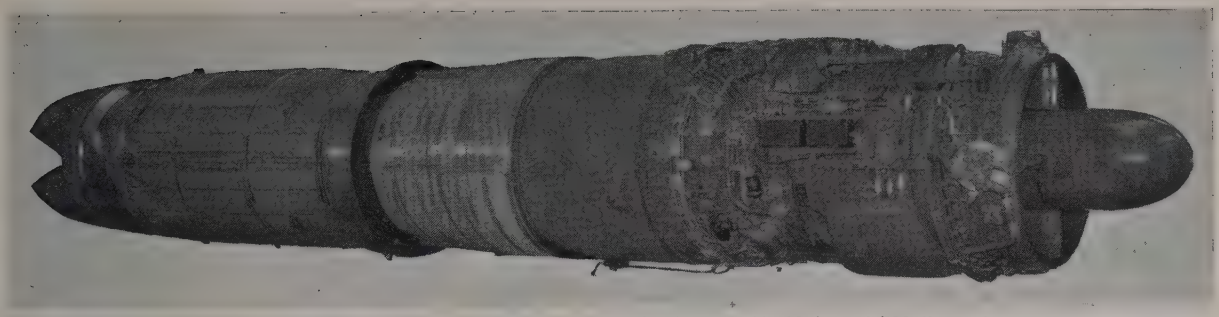
THE SNECMA ATAR 8 AND 9.

The Atar 8 is a large axial-flow turbojet engine of completely new design which was exhibited in public for the first time at the 1955 *Salon de l'Aéronautique*. Its external characteristics can be gathered from the illustration on this page.

The Atar 8 incorporates many refinements resulting from experience with earlier engines of the Atar series, and has nine compressor stages compared with eight on the Atar 101 Series and a two-stage turbine, compared with a single-stage on the earlier Series. It has a



The SNECMA Atar 9 turbojet with afterburner (6,000 kg.=13,225 lb. s.t.).



The SNECMA Atar 101G.2 turbojet with afterburner (4,400 kg.=9,700 lb. s.t.).

preliminary thrust rating, without reheat, of 4,400 kg. (9,700 lb.) at 8,400 r.p.m. and a specific fuel consumption of 0.91 kg./kg. s.t./hr. (0.91 lb./lb. s.t./hr.) at cruise power. Its specific weight is only 0.21 kg./kg. s.t. (0.21 lb./lb. s.t.).

A version with afterburner is also being developed as the Atar 9, with an initial rating of 6,000 kg. (13,225 lb.) s.t. at 8,400 r.p.m., with a specific fuel consumption of 2.0 kg./kg. s.t./hr. (2.0 lb./lb. s.t./hr.) when the afterburner is in use.

DIMENSION (Atar 8).—
Diameter 920 mm. (36.22 in.).

DRY WEIGHT (Atar 8).—
Without tailpipe 920 kg. (2,028 lb.).

THE SNECMA ATAR 101 SERIES.

The Atar 101 has been under development for a number of years, the earliest versions being the Atar 101A, 101B and 101C which developed 2,200 kg. (4,850 lb.), 2,400 kg. (5,290 lb.) and 2,800 kg. (6,170 lb.) s.t. respectively. These have been succeeded by the following production versions.

Atar 101D. 3,000 kg. (6,610 lb.) s.t. Fitted in production version of Dassault M.D. 452 Mystère II.

Atar 101E.3. 3,500 kg. (7,716 lb.) s.t. Installed in production S.O. 4050 Vautour and prototypes of S.E. 5003 Baroudeur, Nord 1500 Griffon and Leduc 0.22. In production.

Atar 101E.4. Development of 101E.3, with same dry weight, dimensions and specific fuel consumption, but developing 3,700 kg. (8,155 lb.) s.t. Completed two 100-hour type tests during 1956. Fitted to Dassault Etendard IV.

Atar 101E.5. Similar to 101E.4, but with compressed air starter instead of electric starter.

Atar 101F. Similar to 101D but fitted with afterburner. 3,800 kg. (8,360 lb.) s.t. with afterburning. Powers Dassault Mystère IV B.

Atar 101G.2. Same as 101E but with afterburner. 4,400 kg. (9,700 lb.) s.t. with afterburning. Powers production Dassault Super-Mystère B-2 and prototypes of the S.E. 212 Durandal, Dassault Mirage III and Nord Gerfaut II. In production.

Atar 101G.4. Variant of 101G.2 developing 4,700 kg. (10,360 lb.) s.t.

The description which follows refers specially to the Atar 101E.

TYPE.—Axial-flow gas turbine with annular combustion chamber and single-stage turbine.

COMPRESSOR. — Eight-stage compressor. Rotor drum built up from individual discs, the rotor blades having prismatic roots which slide into corresponding slots in the periphery of the discs. Stub shafts flanged on each end of drum run in ball (forward) and roller (aft) bearings. Two-piece light alloy casing with inserted light metal guide vanes. Between compressor and combustion chamber is an entry casing which, apart from the ring of burners and fuel injectors, contains the rear compressor bearing and the drives for accessories and oil pumps. Compression ratio 4.8 at 8,400 r.p.m.

COMBUSTION CHAMBER.—Sheet steel annular chamber with twenty single burners. Air from compressor is divided into primary and secondary air at the combustion ring, the primary air alone streaming through burners. The secondary air is ducted to enter the combustion chamber through the holes of the concentrically arranged inner annular liners. Fuel is injected downstream into primary air through ATAR 661 dual-flow injectors. The chamber includes also two starting pre-chambers, two starter burners, two resistance starting plugs.

FUEL SYSTEM.—ATAR 534 fuel pump unit consisting of centrifugal pump, filter and high-pressure gear type pump. ATAR single-lever control regulating automatically r.p.m. and temperature.

FUEL SPECIFICATION.—Turbofuel Normal AIR 3405 (density 0.810) or JP-4.

NOZZLE GUIDE VANES.—Air-cooled sheet steel nozzle guide vanes precede the turbine.

TURBINE.—Single-stage turbine with fifty-nine blades of chrome-nickel alloy. Turbine drives the compressor *via* a movable tooth coupling and a large hollow shaft.

JET PIPE.—Variable area type, with two clamshell shutters, moved by hydraulic servo-mechanism.

ACCESSORY DRIVES.—Drive on compressor entry casing for permanent output of 21 mkg. for driving airframe accessories.

LUBRICATION.—Dry sump. One pressure pump and scavenge pumps. Centrifugal oil cleaner in oil return. Oil-fuel heat exchanger. Normal oil pressure 4 kg./cm.² (57 lb./sq. in.).

STARTING.—Air Equipement 50.999 electric starter. High energy ignition system.

DIMENSIONS (Atar 101E).—
Length 4.13 m. (162.6 in.).
Diameter 0.92 m. (36.2 in.).

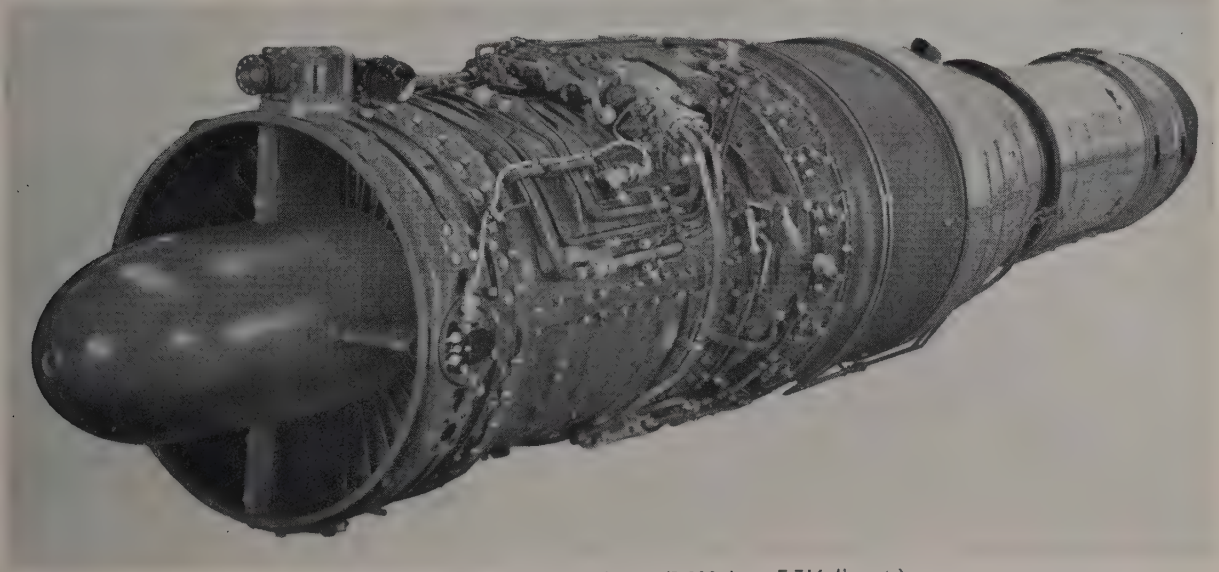
DIMENSIONS (Atar 101G with afterburner).—
Length 6.48 m. (255 in.).
Diameter 0.92 m. (36.2 in.).

WEIGHT DRY (Atar 101E).—
882 kg. (1,945 lb.) with accessories and tail pipe.

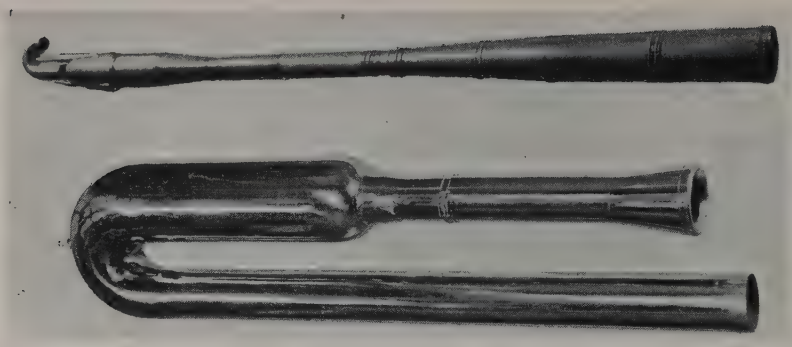
WEIGHT DRY (Atar 101G).—
1,230 kg. (2,712 lb.).

PERFORMANCE RATINGS (Atar 101E.3).—
Max. s.t. at S/L. 3,500 kg. (7,716 lb.) at 8,400 r.p.m.
Max. continuous at S/L. 2,800 kg. (6,173 lb.) at 8,050 r.p.m.
Cruising s.t. at S/L. 2,400 kg. (5,291 lb.) at 7,850 r.p.m.

PERFORMANCE RATINGS (Atar 101G.2).—
Max. s.t. at S/L. with afterburner 4,400 kg. (9,700 lb.) at 8,400 r.p.m.
Max. s.t. at S/L. without afterburner 3,400 kg. (7,495 lb.) at 8,400 r.p.m.
Max. continuous at S/L. 2,700 kg. (5,952 lb.) at 8,050 r.p.m.
Cruising s.t. at S/L. 2,300 kg. (5,070 lb.) at 7,850 r.p.m.



The SNECMA Atar 101E.3 turbojet (3,500 kg.=7,716 lb. s.t.).



Two SNECMA pulse-jet units, the Escopette above and the Ecrevisse below.

SNECMA PULSE-JETS.

SNECMA has been engaged since 1950 in the development of pulse-jet units which are devoid of all valves or other moving parts, being of the resonant-duct type.

Although they have no moving parts, they are able to develop power while static, unlike a ramjet engine. And, despite their low-pressure cycle, they have a specific fuel consumption of the same order as that of a turbojet engine with afterburner.

The pulse-jets incorporate automatic induction and ignition techniques developed by SNECMA, and have been produced in various forms, ranging in power from 10 kg. (22 lb.) to 150 kg. (330 lb.) s.t. each. The first was the Escopette (Carbine) with a power of 10 kg. (22 lb.) s.t., followed by the Ecrevisse (Crayfish) in which the duct is bent double through 180°.

So far these pulse-jets have been utilised mainly as power-plants for target aircraft, but their use as rotor-tip propulsion units for helicopters is being studied. They are also being developed as static power-plants, particularly for agricultural applications in the form of insecticide-spraying equipment.

TURBOMECA

SOCIÉTÉ TURBOMECA.

HEAD OFFICE AND WORKS: BORDES (BASSES-PYRÉNÉES).

PARIS OFFICE: 1, RUE BEAUJON, PARIS 8E.

President and Director General: J. R. Szydlowski.

The Société Turbomeca was formed in 1938 by MM. Szydlowski and Planiol to develop blowers, compressors and turbines for aeronautical use.

In 1947 the company began the development of gas-turbines of low power for driving aircraft auxiliaries and for aircraft propulsion.

The range of Turbomeca gas-turbine engines now includes the Gabizo (1,100 kg.=2,420 lb. s.t.), Gourdon (660 kg.=1,450 lb. s.t.), Marboré II (400 kg.=880 lb. s.t.), Arbizon (250 kg.=550 lb. s.t.) and Palas (160 kg.=353 lb. s.t.) turbojet engines; the Soulor (320 kg.=700 lb. s.t.) ducted-fan engine; the Marcadau (400 s.h.p.) and Astazou (320 h.p.) turboprops; the Bastan (650 s.h.p.), Turmo (270-750 s.h.p.), and Artouste (400-650 s.h.p.) shaft turbines; and the Autan, Tramontane and Palouste air compressors.

Both the Palas and Marboré turbojets are installed in a number of aircraft. The Marboré II powers, among other aircraft, the Fouga 170 Magister twin-engined trainer which is in production for the French Air Force and the French Navy, and the Morane-Saulnier 760.

The shaft turbine engines are suitable for many applications where useful horse-power is required at a single mechanical coupling. The Artouste II engine drives the rotor of the Sud-Est 3130 Alouette II helicopter, which holds the helicopter altitude record at 8,215 m. (26,936 ft.) and is in production for the French Navy. It also powers the American Sikorsky S-59 helicopter.

The compressed air generators are also suitable for many applications, including helicopter power-drives, starting power for large gas-turbines, etc. The Palouste supplies propulsive air to the rotor-tip jets of the S.O. 1221 Djinn helicopter.

A remarkable degree of interchange-ability exists among the whole range of Turbomeca engines.

Licences for Turbomeca gas-turbines have been negotiated with the Blackburn and General Aircraft, Ltd. in England, and the Continental Aviation & Engineering Corporation in the United States.

THE TURBOMECA PALAS.

TYPE.—Turbojet with single-stage compressor, annular combustion chamber with rotating fuel delivery ring and single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor. Compression ratio 3.9 : 1.

COMBUSTION CHAMBER.—Annular, with rotary fuel injection. The fuel ring, around the periphery of which are a number of vents, is attached to the shaft connecting compressor and turbine discs and revolves with it. Fuel is fed into the inside of the ring and is vented by centrifugal force, being vaporised in the process. Fuel delivery at low thrust settings regulated by by-pass valve.

TURBINE.—Single-stage single-piece turbine with 31 blades preceded by stator with twenty air-cooled vanes. Turbine r.p.m. 35,000. Gas temperature before turbine 700°C., after turbine 600°C.

FUEL PUMP.—Turbomeca. Maximum pressure 4 kg./cm.² (57 lb./sq. in.).

FUEL.—Kerosene.

STARTER.—Air Equipement 24 volt electric or compressed-air starter. Two igniter plugs.

MOUNTING.—Three mounting pads, two on compressor casing and one on underside of combustion chamber.

DIMENSIONS.—
Length 891 mm. (35.1 in.).
Diameter 405 mm. (16 in.).

WEIGHT DRY.—
72 kg. (159 lb.).

PERFORMANCE RATINGS.—
Max. T.O. (static) 160 kg. (353 lb.).
Normal thrust 130 kg. (287 lb.).

FUEL CONSUMPTIONS.—
At max. T.O. 1.17 kg./kg. s.t./hr. (1.17 lb./lb. s.t./hr.).
At normal thrust 1.13 kg./kg. s.t./hr. (1.13 lb./lb. s.t./hr.).

THE TURBOMECA ARBIZON.

The Arbizon, introduced in 1955, is a development of the Palas with a two-stage compressor, consisting of an axial stage followed by a centrifugal stage, and a two-stage turbine.

DIMENSIONS.—
Diameter 405 mm. (16 in.).

WEIGHT DRY.—
104 kg. (229 lb.).

PERFORMANCE RATINGS.—
Max. T.O. (static) 250 kg. (550 lb.).
Max. continuous 200 kg. (440 lb.).

THE TURBOMECA MARBORÉ II.

TYPE.—Turbojet with single-stage compressor, annular combustion chamber and single-stage turbine.

AIR INTAKE.—Annular sheet metal nose intake bolted to front of light alloy compressor casing.

COMPRESSOR.—Single-sided impeller machined from two alloy forgings, shrunk on steel shaft and locked and dowelled to maintain alignment. Externally-finned light alloy compressor casing supports front ball-bearing for rotating assembly in a central housing supported by three streamlined struts. This housing also contains gears for accessory drives. Compression ratio (at maximum r.p.m.) 3.95 : 1. Mass air flow 7.5 kg./sec. (16.55 lb./sec.).

COMBUSTION CHAMBER.—Composed of inner and outer sheet metal casings, forming annular flame tube. Air from compressor passes through both radial and axial diffuser vanes and divides into three main flows, two primary for combustion and one secondary. Two primary flows enter combustion zone from opposite ends of chamber, the rear stream through turbine nozzle guide vanes which it cools. Secondary flow enters through outer casing for dilution and cooling of combustion gases. Two torch igniters.

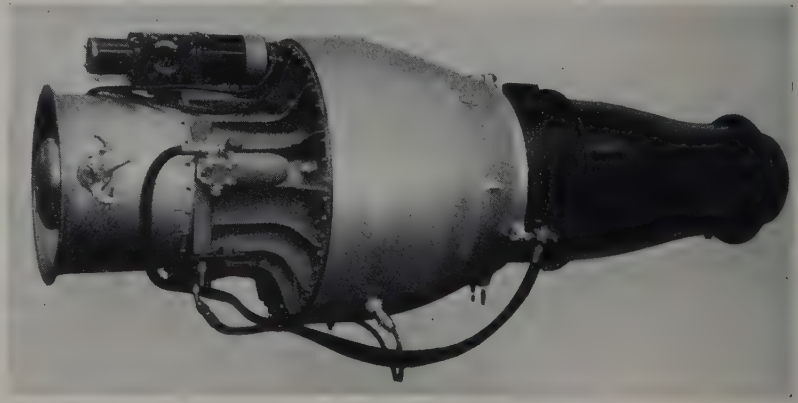
FUEL SYSTEM.—Fuel, pumped through hollow impeller shaft, is fed to combustion zone by rotating injector disc around periphery of which are number of vents which act as nozzles. Fuel is vented by centrifugal force, being atomised in the process. Fuel delivery at low thrust settings regulated by by-pass valve.

FUEL GRADE.—Aviation Turbofuel (D.Eng. R.D. 2482 or JP-4).

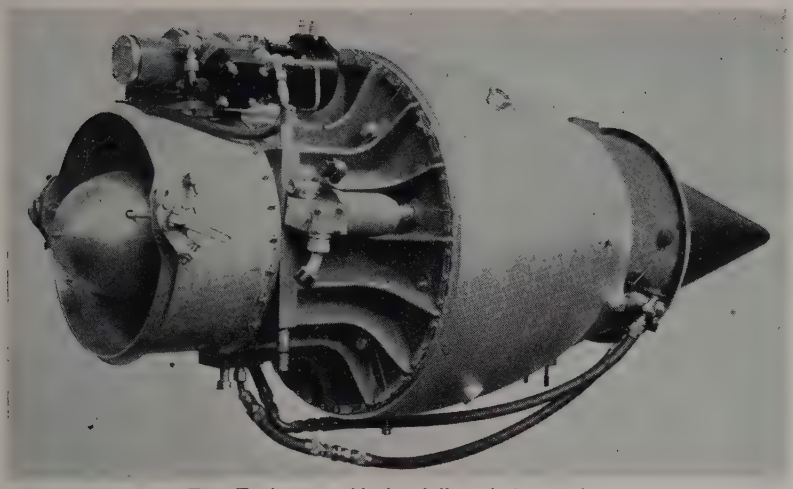
NOZZLE GUIDE VANES.—Twenty-five hollow sheet steel guide vanes cooled by part of primary combustion air.

TURBINE.—Single-stage turbine with thirty-seven blades integral with steel disc. Bolted to main shaft and tail shaft, latter supported by rear roller bearing for rotating assembly.

JET PIPE.—Inner and outer sheet metal casings, latter supported by three hollow struts. Inner tapered casing extends beyond end of outer casing to induce air-flow through struts to cool rear main bearing and inner casing.



The Turbomeca Palas turbojet engine.



The Turbomeca Marboré II turbojet engine.

ACCESSORY DRIVES.—Gear casing in central compressor housing with drives for fuel and oil pumps. Connecting shaft to underside of accessories gear case above compressor casing. Accessories include tachometer generator and electric starter. Take-off (4 h.p. continuous) for remotely-driven accessory box.
LUBRICATION SYSTEM.—Pressure type. Single gear-type pump serves front gear casing, two main bearings and r.p.m. governor. Three scavenge pumps return bearing oil to tank *via* cooler. Normal oil pressure 2.8 kg./cm.² (40 lb./sq. in.).
OIL SPECIFICATION.—D.Eng. R.D. 2479.
MOUNTING.—Four points, with Silentbloc rubber mountings, two at front and two at rear.
STARTING.—Air Equipement 24-volt electric starter or compressed-air starter. Two igniter plugs.
DIMENSIONS.—
Length 1,100 mm. (44.3 in.).
Width 567 mm. (22.3 in.).
Height 288 mm. (11.4 in.).
WEIGHT.—
135 kg. (298 lb.).
PERFORMANCE RATINGS.—
Take-off (static) 400 kg. (880 lb.).
Max. continuous 360 kg. (795 lb.).
CONSUMPTIONS.—
Fuel (T.O.) 1.15 kg./kg. thrust/hr. (1.15 lb./lb. s.t./hr.).
Fuel (max. cont.) 1.10 kg./kg. thrust/hr. (1.10 lb./lb. s.t./hr.).

THE TURBOMECA GOURDON.

The Gourdon, introduced in 1955, is a centrifugal-flow turbojet engine of typical Turbomeca configuration. It has the following characteristics.

DIMENSIONS.—
Diameter 564 mm. (22.5 in.).
WEIGHT DRY.—
172 kg. (380 lb.).
PERFORMANCE RATING.—
Max. T.O. (static) 660 kg. (1,450 lb.).
Max. continuous 525 kg. (1,150 lb.).
FUEL CONSUMPTIONS.—
At max. T.O. 1.02 kg./kg. s.t./hr. (1.02 lb./lb. s.t./hr.).
At max. continuous 0.96 kg./kg. s.t./hr. (0.96 lb./lb. s.t./hr.).

THE TURBOMECA GABIZO.

The Gabizo, a development of the Marboré II, was designed to meet the French Air Ministry requirements for an engine to power the light-weight fighter aircraft under development for the new French defence programme. It has a two-stage compressor, consisting of an axial stage followed by a centrifugal stage, with an annular combustion chamber, single-stage turbine and Nord afterburner with two-position nozzle. Mass flow is approximately 20 kg. (45 lb.) sec. and pressure ratio 5 : 1.

The Gabizo successfully completed an official 20-hour type test in May, 1955 and an 150-hour type test in December, 1955. During flying tests beneath the fuselage of a Canberra in 1956, a Gabizo equipped with an afterburner was run at a height of 16,350 m. (53,640 ft.). It is also undergoing flight trials in the specially-built Fouga Makalu flying test-bed.

DIMENSIONS.—
Length, with afterburner 3,610 mm. (142.2 in.).
Diameter 670 mm. (26.5 in.).
WEIGHT DRY.—
With afterburner 335 kg. (740 lb.).
PERFORMANCE RATINGS.—
Max. T.O. (static) 1,100 kg. (2,420 lb.).
Max. continuous 880 kg. (1,940 lb.).
Max. T.O. with afterburner 1,540 kg. (3,395 lb.).
FUEL CONSUMPTIONS.—
At max. T.O. 1.04 kg./kg. s.t./hr. (1.04 lb./lb. s.t./hr.).
At max. continuous 0.96 kg./kg. s.t./hr. (0.96 lb./lb. s.t./hr.).

THE TURBOMECA SOULOR.

The Soulor, which is under development, is a ducted-fan engine, based on the Autan turbo-generator.

DIMENSIONS.—
Diameter 460 mm. (18.5 in.).
WEIGHT DRY.—
140 kg. (310 lb.).
PERFORMANCE RATINGS.—
Max. T.O. 320 kg. (700 lb.).
Max. continuous 270 kg. (600 lb.).
FUEL CONSUMPTIONS.—
At max. T.O. 0.8 kg./kg. s.t./hr. (0.8 lb./lb. s.t./hr.).

THE TURBOMECA MARCADAU.

The Marcadau is the Artouste II turbine with an airscrew reduction gear of the spur type. The reduction gear ratio is 1 : 2.332. The centre-line of the airscrew shaft is 130 mm. (5.1 in.) below the turbine shaft centre-line.

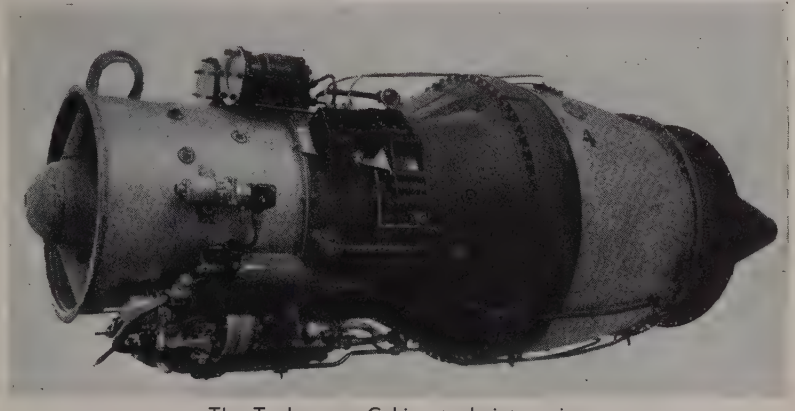
DIMENSIONS.—
Length 1,390 mm. (54.8 in.).
Height 545 mm. (21.5 in.).
Width 452 mm. (17.8 in.).
WEIGHT (without airscrew).—
139 kg. (307 lb.).
PERFORMANCE.—
T.O. output 400 h.p. at 2,500 shaft r.p.m. plus 35 kg. (77 lb.) residual thrust.
Max. climb output 360 h.p. at 2,500 shaft r.p.m. plus 32 kg. (70 lb.) residual thrust.
Max. continuous output 320 h.p. at 2,500 shaft r.p.m. plus 30 kg. (66 lb.) residual thrust.

THE TURBOMECA ASTAZOU.

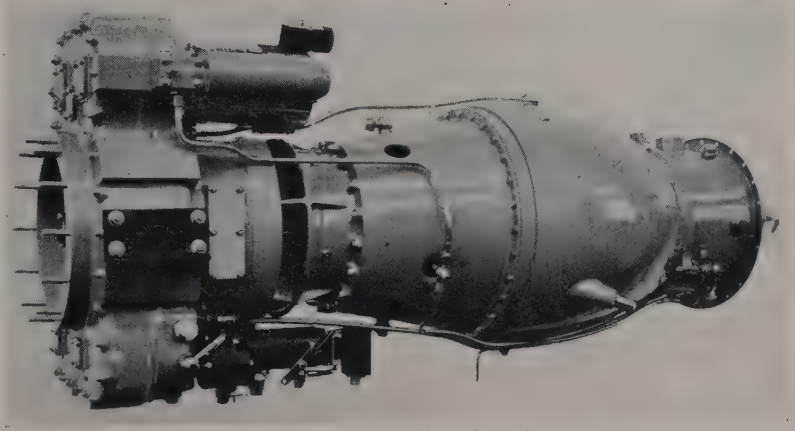
The Astazou turboprop is one of a completely new range of Turbomeca engines, incorporating the experience gained with earlier series and making use of new design techniques. First displayed at the 1957 Paris *Salon*, it has an extremely small gas-producer section.

The two-stage compressor consists of an axial stage followed by a centrifugal stage, with an annular combustion chamber and multi-stage turbine. Accessories are mounted on the rear of the main intake casting.

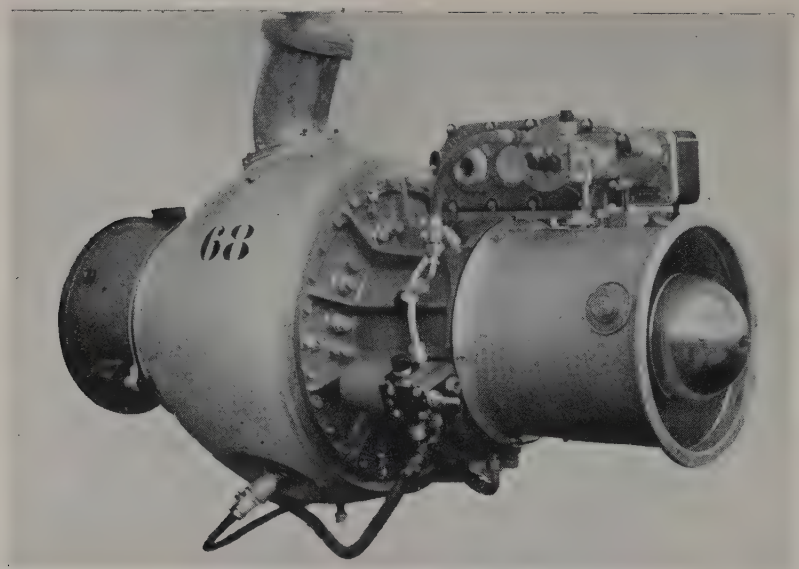
DIMENSIONS.—
Length approx. 1,753 mm. (69 in.).
Diameter 460 mm. (18.1 in.).
DRY WEIGHT.—
111 kg. (245 lb.).
PERFORMANCE RATING.—
Max. T.O. 320 h.p.
FUEL CONSUMPTION.—
0.33 kg. (0.72 lb.) per h.p./hr.



The Turbomeca Gabizo turbojet engine.



The Turbomeca Artouste III shaft turbine engine.



The Turbomeca Palouste IV turbo-compressor.

THE TURBOMECA ARTOUSTE II.

The Artouste is a shaft turbine. The two-stage turbine uses part of the available power to drive the compressor, the remaining power being free to drive a power take-off shaft.

TYPE.—Gas-turbine with centrifugal compressor, an annular combustion chamber and a two-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor. Compression ratio at 33,000 r.p.m. at S/L. 3.7 : 1. Air mass flow 3.1 kg./sec. (6.8 lb./sec.) at 33,000 r.p.m. at S/L.

COMBUSTION CHAMBER.—Annular type as in Palas.

FUEL.—AIR 3405 turbofuel. Normal aviation gasoline for starting.

OIL.—AIR 3512 (mineral) oil.

TURBINE.—Two-stage axial type. 1st stage 20 stator blades and 27 rotor blades. 2nd stage 34 stator blades and 25 rotor blades.

JET PIPE.—Fixed type. Diameter of diffuser exit 310 mm. (12.2 in.). Exhaust gas speed 100 m./sec. (328 ft./sec.) maximum. Exhaust gas temperature 550°C. maximum.

STARTING.—Air Equipement 24-volt starter. Two K.L.G. igniter plugs.

DIMENSIONS.—
Length 1,060 mm. (41.7 in.).
Height 545 mm. (21.5 in.).
Width 452 mm. (17.8 in.).

WEIGHT.—
110 kg. (242 lb.).

PERFORMANCE.—
Max. output (5 min.) 400 s.h.p. at 33,000 turbine r.p.m. plus 35 kg. (77 lb.) residual thrust at S/L.
Max. continuous output 320 s.h.p. at 33,000 turbine r.p.m. plus 30 kg. (66 lb.) residual thrust at S/L.

FUEL CONSUMPTIONS.—
At max. output 177 kg. (389 lb.) per hour.
At max. continuous output 160 kg. (352 lb.) per hour.

THE TURBOMECA ARTOUSTE III.

This is a developed version of the Artouste II which has the following characteristics.

WEIGHT DRY.—
150 kg. (330 lb.).

PERFORMANCE.—
Max. output (5 min.) 650 s.h.p.
Max. continuous output 500 s.h.p.

THE TURBOMECA BASTAN.

One of the new generation of Turbomeca engines, first shown with the Astazou turboprop at the 1957 Paris *Salon*, the Bastan is a turboprop engine which has been chosen to power the Morane-Saulnier Epervier, S.E. Fonceur and other new aircraft. It has a two-stage compressor, consisting of an axial stage followed by a centrifugal stage, with an annular combustion chamber and multi-stage turbine.

DIMENSIONS.—
Length 1,545 mm. (60.9 in.).
Diameter 550 mm. (21.6 in.).

DRY WEIGHT.—
Without airscrew 180 kg. (397 lb.).

PERFORMANCE RATING.—
Max. T.O. 650 s.h.p. at 33,000 r.p.m.

FUEL CONSUMPTION.—
0.33 kg. (0.73 lb.) per h.p./hr.

THE TURBOMECA TURMO.

The Turmo is a shaft turbine which consists of a gas generator, comprising a compressor, combustion chamber and a single-stage turbine, the exhaust from which drives a "free" single-stage turbine. The "free" turbine drives the output shaft through a reduction gear. This kind of unit has the advantage of a very high starting torque.

A Turmo I was fitted in the *Etoile Filante* which set up a World speed record for turbine-powered cars in 1956.

DIMENSIONS (Turmo I).—
Length 1,146 mm. (45.2 in.).
Width 700 mm. (27.6 in.).
Height 550 mm. (21.7 in.).

DIMENSIONS (Turmo III).—
Length 1,663 mm. (65.5 in.).
Width 798 mm. (31.4 in.).
Height 565 mm. (22.25 in.).

WEIGHT (Turmo I and III).—
240 kg. (530 lb.).

PERFORMANCE (Turmo I).—
Max. shaft output 270 h.p. at 3,500 r.p.m.
Max. continuous shaft output 230 h.p. at 3,000 r.p.m.
Gas generator speed (max. continuous) 33,750 r.p.m.

PERFORMANCE (Turmo II—without gearbox).—
Max. shaft output 400 h.p. at 28,000 r.p.m.
Max. continuous shaft output 360 h.p. at 24,000 r.p.m.
Gas generator speed (max. continuous 33,000 r.p.m.

PERFORMANCE (Turmo III).—
Max. shaft output 750 h.p.

FUEL CONSUMPTIONS.—
At max. continuous output (Turmo I) 112 kg. (247 lb.) per hour.
At max. continuous output (Turmo II) 180 kg. (397 lb.) per hour.
At max. continuous output (Turmo III) 263 kg. (580 lb.) per hour.

THE TURBOMECA PALOUSTE IV.

The Palouste is a turbo-generator which incorporates an oversize impeller in its compressor so that a proportion of the air may be taken from the engine after compression but before it enters the combustion chamber.

The combustion chamber, turbine, accessory drives, etc. of the Palouste are similar to those of the Artouste.

After completing successfully a 150-hour Type Test in 1956, a Palouste IV was kept running for two further periods of 150 hours as an endurance test. In all, it completed 502 hours of running without fault.

This engine powers the S.O. 1221 Djinn helicopter.

DIMENSIONS.—
Length 1,060 mm. (41.8 in.).
Height 500 mm. (19.7 in.).
Width 475 mm. (18.7 in.).

WEIGHT (with accessories).—
90 kg. (198 lb.).

PERFORMANCE (at ambient temperature of up to 45°C.).—
Air delivery (3.6 compression ratio) 860 gr./sec. (1.89 lb./sec.) at 35,000 r.p.m.
Air delivery (3.48 compression ratio) 760 gr./sec. (1.67 lb./sec.) at 34,000 r.p.m.

THE TURBOMECA AUTAN.

The Autan, introduced in 1955, is a development of the Palouste, with a two-stage (axial followed by centrifugal) compressor. It has the following characteristics.

DIMENSION.—
Diameter 405 mm. (16 in.).

WEIGHT (with accessories).—
118 kg. (260 lb.).

PERFORMANCE.—
Air delivery (5.1 compression ratio) 1,350 gr./sec. (3 lb./sec.).

FUEL CONSUMPTION.—
180 kg./hr. (400 lb./hr.).

THE TURBOMECA TRAMONTANE.

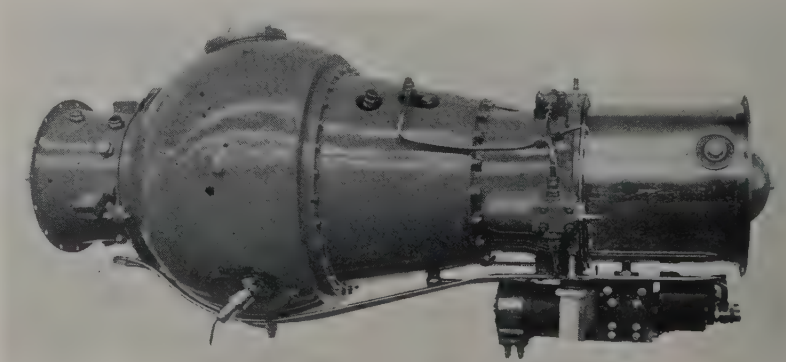
First shown at the 1957 Paris *Salon*, the Tramontane is a turbo-generator, or air compressor, in which air is supplied from two outlets, one on each side of the main casing. It has a single centrifugal compressor of Marboré size, an annular combustion chamber and two-stage turbine. Mass flow is approximately 7.56 kg. (16.7 lb.) sec. and pressure ratio 3.5 : 1.

DIMENSIONS.—
Length without tailcone 1,200 mm. (47.3 in.).
Diameter 577 mm. (22.75 in.).

DRY WEIGHT.—
168 kg. (370 lb.).

PERFORMANCE.—
Air delivery 2.5 kg. (5.5 lb.) sec. at 22,600 r.p.m.

FUEL CONSUMPTION.—
308 kg. (680 lb.) hr.



The Turbomeca Autan turbo-compressor.

GERMANY

GERMAN FEDERAL REPUBLIC

BMW

BMW STUDIENGESELLSCHAFT FÜR TRIEBWERKSBAU G.m.b.H.

HEAD OFFICE: LERCHENAUERSTRASSE 76, MUNICH 13.

WORKS: MUNICH-ALLACH AND MILBERTSHOFEN.

The nucleus of the new BMW company was formed as a "study group" in December, 1954, under the leadership of Helmuth Sachse, technical director of the former company and one-time chief of the aircraft engine division of the German Air Ministry.

Its aero-engine production centre at Munich-Allach escaped serious damage during the war and is available for production. Facilities include more than 50 engine test-beds. Many of the technicians who designed and engineered the wartime series of BMW piston, gas-turbine and rocket engines, and have since worked in Russia, France and other countries, will be available when BMW resume aero-engine production.

During 1956-57, B.M.W. began to reorganise its factory for probable production under licence of Lycoming GO-480 engines to power the Piaggio P.149 aircraft being built by Focke-Wulf and the Dornier Do 27.

The company expects also to handle the maintenance and overhaul of the Orenda 10 and 14 turbojet engines fitted to Canadair Sabre Mk. 5 and Mk. 6 aircraft of the West German Air Force.

DAIMLER-BENZ

DAIMLER - BENZ AKTIENGESELLSCHAFT.

HEAD OFFICE AND WORKS: STUTTGART-UNTERTÜRKHEIM.

This famous company, which is the descendant of the oldest automobile factory in the world, has been building aero-engines since the early years of this century when it supplied the power-plants for Count Zeppelin's airships. Its later products culminated in the DB 601, 603, 605, 606 and 610 high-powered inverted liquid-cooled piston-engines which were fitted in a high proportion of Germany's wartime aircraft.

The company's large works at Stuttgart have been re-built and are at present engaged on producing engines for road vehicles. No aircraft engine production has yet been undertaken; but in April, 1957, Daimler-Benz signed an export agreement with three U.S. companies, including the Curtiss-Wright Corporation, one section of which gives Daimler-Benz the licence to service, and eventually build, Curtiss-Wright aircraft engines in Germany.

HEINKEL

ERNST HEINKEL AKTIENGESELLSCHAFT.

HEAD OFFICE AND WORKS: HELLMUTH - HIRTH - STRASSE, STUTTGART - ZUFFENHAUSEN.

Chairman and General Manager: Alfred Klein.

Director: Hans Nürnberger.

Sales Director: F. W. Seekatz.

The Ernst Heinkel Aktiengesellschaft had its origin in the former Ernst Heinkel Flugzeugwerke of Warnemünde and Rostock, which began development of gas-turbine engines in 1936 and built the He S 3B turbojet which powered the Heinkel He 178, the first jet-propelled aeroplane to fly, on August 27, 1939.

After 1945, only the plant at Stuttgart-Zuffenhausen was left of the former works at Rostock, Berlin-Oranienburg, Berlin-Waltersdorf, Wien-Schwechat and Jenbach/Tirol. The development and production of small engines in the 50-1,100 cc. class was undertaken at this works, together with the production of motor scooters and three-wheeled vehicles.

To supplement these activities it is intended to undertake the maintenance and repair of gas-turbine engines for the West German Air Force, and the design and production of aero-engines.

ITALY

FIAT

FIAT, SOCIETÀ PER AZIONI.

AERO-ENGINE WORKS : VIA NIZZA 312, TURIN.

Full details of the present organisation of the Fiat Company are given in the "Aeroplane" Section of this work.

The Fiat Company was incorporated in 1899 and built its first aero-engines in 1908.

Fiat entered the gas-turbine field after the last war, by undertaking first the licence-production of the de Havilland Ghost centrifugal-flow turbojet engine and then, in 1953, the manufacture of parts and assemblies of the Allison J35 turbojet engine for the U.S.A.F.

In addition to this work, the Company is responsible for the maintenance and repair of de Havilland Goblin engines for the Italian Air Force ; overhaul and repair of components of the General Electric J47 turbojet engine (European Centre) ; and the manufacture of component parts of the J65 Sapphire turbojet engine, produced by the Curtiss-Wright Corporation, on behalf of the U.S.A.F. in Europe.

Fiat further undertakes, for the Italian Air Force and the Italian civil airlines, the overhaul and repair of several types of piston engines, including the Fiat RA. 1050 (D.B.605) ; Pratt & Whitney R-985, R-1830 and R-2800 ; and Rolls-Royce Merlin 500.

New factories have been built for this work, together with a test establishment of the most up-to-date design.

The first products of the Company's own research and design studies in the gas-turbine field are the Model 4002 turbojet engine for small and medium-sized civil and military aircraft, and the Model 4700 turbo-generator for helicopter use. Details of these units are given below.

THE FIAT 4002.

The Fiat 4002 turbojet engine is intended for small and medium-sized civil and military aircraft. Special attention has been paid in its design to structural simplicity and consequent ease of production.

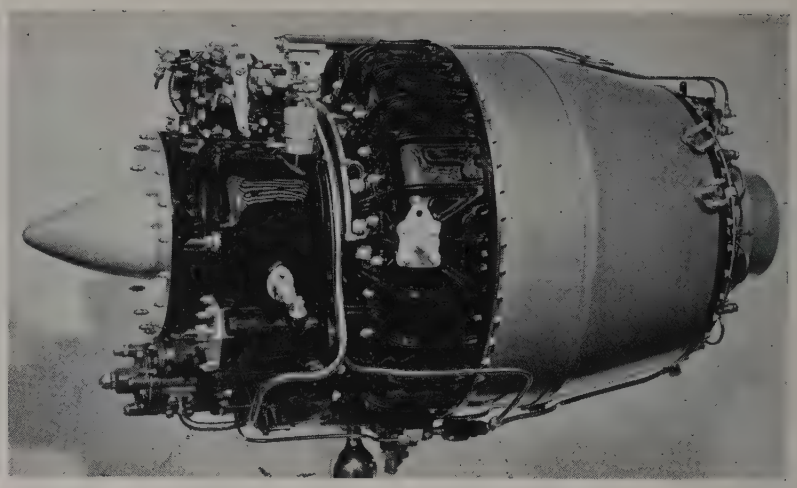
Its designers have concentrated on keeping length, rather than frontal area, to a minimum ; because the minimum cross-sectional area of a single-engined aircraft is governed by factors such as cockpit size rather than by the frontal area of its engine.

Two versions were exhibited at the 1957 Paris *Salon*, as follows :—

4002.000. Initial version, as described in detail below.

4002.001. Developed version with redesigned combustion system, giving considerably reduced overall length and increased power. Has sixteen flame-tubes.

TYPE.—Centrifugal-flow turbojet with single stage turbine.



The Fiat 4002 Lightweight turbojet engine.

COMPRESSOR.—Single-stage centrifugal compressor in two parts, which are secured to the shaft by splines and connected together by three dowels. The first part has curved blades to cater for the axial inflow of air : the second part has radial blades. Compression ratio approx. 4 : 1. Air mass flow 11 lb. (5 kg.) per sec. at 26,000 r.p.m.

COMPRESSOR HOUSING.—This consists of a light alloy casting.

COMBUSTION CHAMBER.—Annular reverse-flow type, with a burner projecting into each of twelve internal "domes."

FUEL SYSTEM.—Fuel is fed to the twelve burners by a Lucas pump, which is fitted with a regulator, controlled by a thermo-regulator mounted on the exhaust cone.

FUEL.—Kerosene.

TURBINE.—Single-stage turbine, connected to the compressor shaft by a six-bolt flange coupling, and with 57 blades made from a material highly resistant to heat and corrosion. The nozzle guide vanes, welded to the inner and outer rings of the turbine diaphragm, are cast by the lost wax process and made hollow for cooling by air from the compressor.

LUBRICATION.—The oil reservoir forms part of the air intake casting, which also houses the oil filters, etc.

STARTING.—Two starting systems, by compressed air acting directly on the compressor blades, and electrical.

DIMENSIONS (Model 4002.000).—
Max. diameter 568 mm. (22.36 in.).
Length 1,034 mm. (40.71 in.).
Frontal area 0.25 m.² (2.73 sq. ft.).

DIMENSION (Model 4002.001).—
Length 886 mm. (34.9 in.).

WEIGHT (DRY) (Model 4002.000).—
99.5 kg. (219 lb.).

WEIGHT (DRY) (Model 4002.001).—
88 kg. (194 lb.).

RATING (Model 4002.000).—
Max. static thrust 270 kg. (594 lb.) at 26,000 r.p.m.

RATING (Model 4002.001).—
Max. static thrust 325 kg. (715 lb.) at 25,000 r.p.m.

CONSUMPTION (Model 4002.000).—
1.25 kg./kg. s.t./hr. (1.25 lb./lb. s.t./hr.).

THE FIAT 4700

The 4700 is a "free turbine" air generator which has been developed for helicopter use. The free air compressor is driven by a hot gas generator which makes use of most of the components of the 4002 turbojet engine previously described. The engine is arranged for vertical mounting so as to reduce the length of the compressed air duct to the rotor.

This engine will power the Fiat 7002 two-seat "cold jet" helicopter, in which the two-blade main rotor will be driven by jets of unheated compressed air at the blade tips.

WEIGHT (Model 4700.000).—
Complete 120 kg. (265 lb.).

POWER RATINGS (Model 4700.000).—
Take-off 523 g.h.p.
Max. continuous 493 g.h.p.

THE FIAT GHOST 48 Mk. 1.

This is a Ghost 3 turbojet engine which is built under a de Havilland licence. Constructional details of the Ghost engine will be found under "de Havilland." The following details are those of the Ghost 48 Mk. 1 as built by Fiat.

DIMENSIONS.—
Diameter 134.6 cm. (53 in.).
Length 331.4 cm. (130.5 in.).
Frontal area 1.42 m.² (15.3 sq. ft.).

WEIGHT.—
986.5 kg. (2,175 lb.).

POWER RATINGS.—
Take-off (static) 2,200 kg. (4,850 lb.) at 10,250 r.p.m. at sea level.
Normal (static) 1,883 kg. (4,150 lb.) at 9,750 r.p.m. at sea level.
Cruising (static) 1,460 kg. (3,220 lb.) at 9,000 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (cruising) 1.07 kg./kg. thrust/hr. (1.07 lb./lb. thrust/hr.).
Oil (max.) 1.7 litres per hr. (3 pints per hr.).

JAPAN

FUJI

FUJI JUKOGYO KABUSHIKI KAISHA (Fuji Heavy Industries Ltd.).

HEAD OFFICE: NAIGAI BUILDING 18, 2-CHOME, MARUNOUCHI, CHIYODA-KU, TOKYO.

AERO ENGINE FACTORIES: MITAKA, TOKYO AND OMIYA, SAITAMA PREFECTURE.

President and Director: Kenji Kita.

Executive Director: Takao Yoshida.

Managing Directors: Tadashi Miki, Tsunehiko Mitsumoto, Tomizo Fujiu, Takeo Kotani and Toshio Matsubayashi.

Fuji Jukogyo Kabushiki Kaisha (Fuji Heavy Industries, Ltd.) was formed on July 15, 1953, to undertake primarily the production of aircraft, aero-engines and accessories. One of the five shareholding companies which took part in its organisation and has since been absorbed therein, the Omiya Fuji Kogyo Kabushiki Kaisha, undertook in 1952 the development of a small axial-flow turbojet engine, for which a Government subsidy of 3,500,000 Yen was granted.

This engine, the JO-1, was completed in the Summer of 1954. Subsequent performance tests were made at the Omiya Division and were completed in December, 1955.

Development of this engine and subsequent Fuji designs has been taken over by the Nippon Jet-Engine Company, of which Fuji was a founder member.

The Fuji Automotive Company has a licence to manufacture in Japan engines designed by the American Continental company, including gas-turbines developed by Continental from basic Turbomeca designs.

ISHIKAWAJIMA

ISHIKAWAJIMA JUKOGYO KABUSHIKI KAISHA (Ishikawajima Heavy Industries, Ltd.).

HEAD OFFICE AND WORKS: 54, TSUKUDAJIMA, CHUO-KU, TOKYO.

On June 19, 1956, the Japanese government approved a licence agreement under which Ishikawajima will produce spares for the General Electric J47-GE-27 turbojet engines which power Mitsubishi-built F-86F Sabre fighters.

This was the first step towards manufacture by Ishikawajima of complete J47 engines, and the licence covers also manufacture of spares for the J47's supplied to the Japanese Air Self Defense Force under M.D.A.P. First deliveries were scheduled for May, 1957.

NIPPON

NIPPON JET-ENGINE COMPANY.

HEAD OFFICE: 1,010, TANASHI-MACHI KITATAMA-GUN, TOKYO.

A number of leading Japanese manufacturers have formed the Nippon Jet-Engine Company to co-ordinate their gas-turbine design and production activities under the auspices of the Japanese government.

The Nippon Jet-Engine Company has taken over from Fuji responsibility for the Model JO-1 turbojet and began test running an improved version known as the J3-1 in the Summer of 1956. It was awarded a contract in March, 1956, to produce three of these engines as part of the development programme for a Japanese light jet training aircraft.

THE N.J.E. MODEL J3-1.

No details have been given of this engine, which began bench tests at the Omiya factory of Fuji Heavy Industries on July 3, 1956, except that it is an axial-flow turbojet with an 8-stage compressor, annular combustion chamber and single-stage turbine, with a rating of 1,200 kg. (2,646 lb.) s.t.

Three pre-production J3-1 engines have been ordered by the Japanese National Defense Agency. One will be fitted under the fuselage of a Curtiss-Wright C-46D transport aircraft for low-altitude flight testing. The other two will be mounted on the wing-tips of a Lockheed T-33A jet trainer for testing at heights above 3,000 m. (9,800 ft.). Both test-bed installations were due for completion in mid-1957.

In due course, the J3-1 will be evaluated in competition with the Bristol Orpheus as the potential power plant of the Fuji T1F1 jet trainer.

THE N.J.E. MODEL JO-1.

TYPE.—Axial-flow Turbojet.

AIR INLET.—Annular nose air inlet surrounding nose bullet.

COMPRESSOR.—Eight-stage axial-flow. First and eighth blade discs of stainless steel, the remainder are aluminium-alloy forgings. Air mass flow approximately 19 kg. (41.8 lb.) sec. Compression ratio about 4.5 : 1.

COMBUSTION CHAMBERS.—Eight straight-through chambers of stainless steel each with a concentrically-mounted perforated stainless steel flame tube with duplex-type fuel injection nozzle in the front end and discharging downstream. Chambers are interconnected to permit flame-spread during starting.

FUEL SYSTEM.—Single fuel-manifold system. Fuel pressure at maximum power 50 kg./cm.² (710 lb./sq. in.).

NOZZLE GUIDE VANES.—Forged steel ring with forty inserted and welded Nimonic 80A nozzle guide vanes.

TURBINE.—Single-stage axial flow, with sixty solid blades inserted in periphery of alloy-steel disc. Gas temperatures (at 12,000 r.p.m.) before turbine 800°C., after turbine 630°C.

JET PIPE.—Outer casing of stainless steel. Fixed inner cone.

LUBRICATION.—Wet sump. Main gear-type pump supplies oil to five main bearings. Auxiliary pump scavenges sump under turbine roller bearings and returns it to main pumps.

STARTING.—Direct-drive electric. Two torch igniters.

DIMENSIONS.—
Length 2,850 mm. (112 in.).
Diameter 680 mm. (26.7 in.).
Frontal area 0.33 m.² (3.56 sq. ft.).

WEIGHT DRY.—
450 kg. (990 lb.).

PERFORMANCE RATINGS.—
Max. static thrust 1,000 kg. (2,200 lb.) at 12,000 r.p.m.
Max. thrust at 800 km.h. (500 m.p.h.) at 9.000 m. (29,520 ft.) 400 kg. (880 lb.).

FUEL CONSUMPTION.—
1.11 kg./kg. s.t./hr. (1.11 lb./lb. s.t./hr.).

POLAND

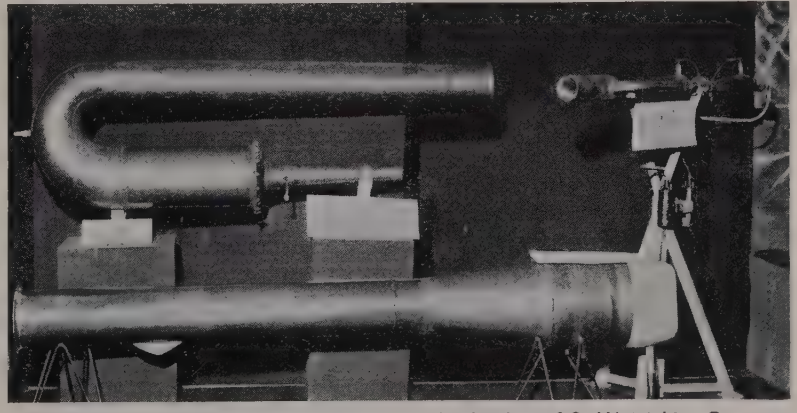
In common with the Polish airframe industry, the country's aero-engine factories were engaged mainly on producing equipment of Russian design until recently, when development of nationally-designed engines has again been encouraged.

Klimov VK-1 turbojets have been in production since at least 1955 to power Polish-built MiG-15 and MiG-17 fighters. The only nationally-designed jet-engines of which details are yet available are the Wojcicki pulsejets described briefly hereafter.

S. WOJCICKI.

S. Wojcicki has designed a pulsejet engine, similar to the French SNECMA Escopette and giving 10 kg. (22 lb.) s.t. Four of these units have been fitted in pairs under the wings of a modified Bocian glider for flight testing. Wojcicki is also developing a more powerful pulsejet of 20 kg. (44 lb.) s.t.

Two Wojcicki pulsejets were built at the I.L. in 1955. Apart from the fact that they develop 40 kg. (88 lb.) s.t. and 70 kg. (154 lb.) s.t. respectively, nothing is known about them. At least two further pulsejets are under development in Poland as private-ventures to power home-built helicopters.



Pulsejet engines developed under the leadership of S. Wojcicki. On the left (above) a 40 kg. (88 lb.) s.t. unit and (below) a 70 kg. (154 lb.) s.t. unit, both completed at the I.L. (Aviation Institute) in 1955. In the top right-hand corner is one of the first Polish pulsejet engines, designed by Oderfeld, Sachs and Bernadzikiewicz, which ran successfully in Warsaw in 1936.

SOVIET UNION

(Union of Socialist Soviet Republics)

THE RD-45 AND RD-45F.

The Russian production version of the Nene, converted to Russian standards by a team of engineers under Chelomey and Klimov after 25 Rolls-Royce-manufactured Nenes and 30 Derwents had been exported to the Soviet Union in 1947, was designated the RD-45. A subsequent improved version was the RD-45F and these engines were built in quantity for initial production versions of the MiG-15 and Il-28. The RD-45F has a rating of approximately 2,470 kg. (5,450 lb.) s.t.

THE RD-500.

RD-500 is the designation of the Derwent 5 built in the U.S.S.R. It retains the main features of its British prototype, and is installed in the Yak-23 jet fighter.

THE VK-1.

Under the leadership of V. Y. Klimov, the Russians developed the Nene in much the same way as that by which the Tay was developed from the Nene by both Rolls-Royce and Pratt & Whitney. Without increasing the overall diameter the engine was re-designed internally, to permit about 30 per cent. more air to pass through the engine, and to enable it to develop a static thrust of 2,700 kg. (5,955 lb.) for an engine weight of 900 kg. (2,000 lb.) as compared with 2,270 kg. (5,000 lb.) s.t. and 780 kg. (1,715 lb.) weight of the original Nene.

Known as the VK-1, the redesigned engine powers the MiG-15*bis* and most production Il-28's. More than 20,000 were built in 1950-56 in Engine Plant No. 45, near Moscow.

The VK-1A which powers the MIG-17 is fitted with an afterburner and has a rated output of 3,450 kg. (7,590 lb.) s.t.

THE VK-5.

The VK-5 is reputedly the power-plant of the MiG-19 and Yak-25. Little is known about this power-unit beyond the fact that it has a rated output of 3,950 kg. (8,690 lb.) s.t. at sea level.

THE LU-4 (?).

The LU-4(?) axial-flow gas turbine is a recent Russian design which is credited to A. M. Lyulka. It is said to have a static thrust rating of 5,200 kg. (11,455 lb.), and four engines of this type are believed to power the Tu-110 airliner. No reliable data are available.

THE M-209 (RD-3).

The Mikulin M-209 is a large but very simple single-spool axial-flow turbojet which powers the Tu-16 bomber and, in a de-rated civil form known as the RD-3, the Tu-104 airliner. It has an eight-stage compressor, "cannular" type combustion system and a two-stage turbine. The civil version has an electric starter and manifolds for cabin pressurisation and hot-air de-icing. Mass flow is estimated at 125 kg. (278 lb.) sec., with a compression ratio of 6.8 : 1. The following data are estimated :—

DIMENSIONS.—
Length 5,080 mm. (200 in.).
Diameter 1,370 mm. (54 in.).
DRY WEIGHT.—
2,495 kg. (5,500 lb.).
PERFORMANCE RATINGS.—
Max. rating (military) 8,200 kg. (18,040 lb.) s.t.
Max. rating (civil) 6,750 kg. (14,850 lb.).

THE ZUBETS TURBOJET.

A developed version of the M-209 has been produced under the design leadership of P. F. Zubets. No details are available, but two engines of this type power the Tu-104A airliner.

THE TYPE 022.

The Type 022 was the first of a series of turboprop engines produced at Kubishev by a strong team of German and Russian engineers. It is based on a wartime German Junkers design and has a simple single-spool axial-flow compressor.

First bench-run in 1950, the Type 022 powers the An-8 transport aircraft.

DIMENSIONS.—
Length 4,500 mm. (177.2 in.).
Diameter 1,050 mm. (41.3 in.).
DRY WEIGHT.—
With accessories 1,400 kg. (3,087 lb.).
PERFORMANCE RATING.—
Max. rating at S/L 5,700 s.h.p. plus approx. 600 kg. (1,323 lb.) jet thrust at 7,650 r.p.m.
CONSUMPTION.—
Fuel at max. rating 0.245 kg. (0.54 lb.) h.p./hr.

THE NK-4.

The NK-4 is a turboprop engine of approximately 4,000 s.h.p., developed by N. D. Kuznetsov. Few details are available, but four NK-4 engines power the Il-18 airliner and have been stated to have a remarkably low specific fuel consumption.

THE IVCHENKO TURBOPROP.

A. G. Ivchenko has developed an improved version of the NK-4 turboprop. No details are available, but four of these engines power the prototype of the An-10 Ukraina and will eventually replace the NK-4 turboprops fitted at present to the Il-18.

THE TYPE K TURBOPROP.

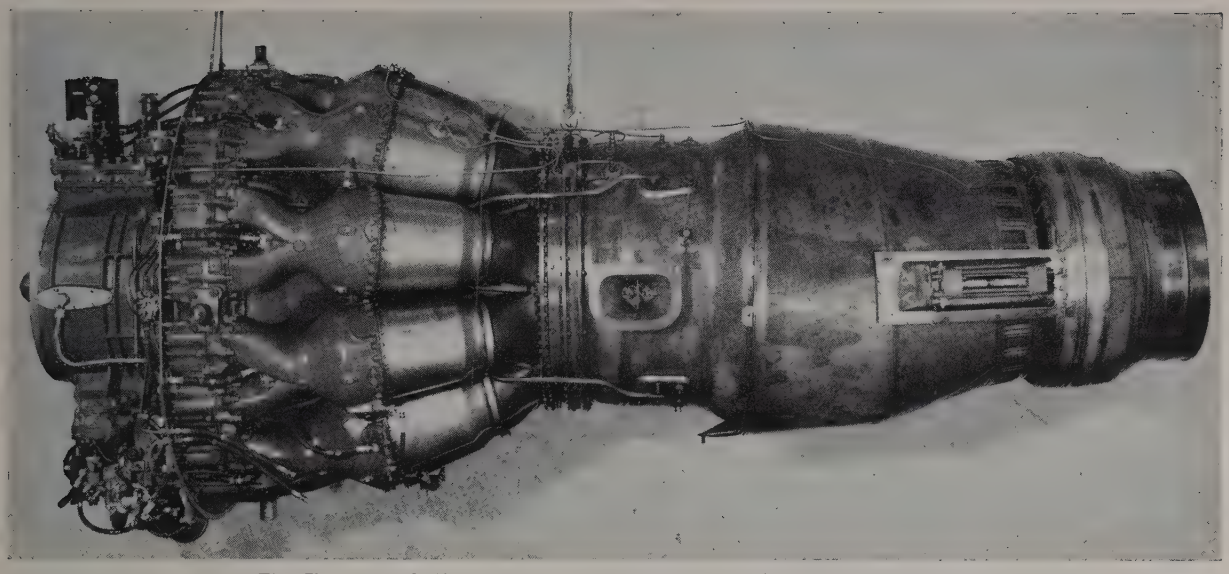
Probably designed at Kubishev under the leadership of N. D. Kuznetsov and German engineers, the Type K (a provisional western designation) is the great turboprop engine of which four power the Tupolev "Bear" bomber. It develops some 12,000 s.h.p. and drives large contra-rotating airscrews.

The Type K has a single 14-stage axial-flow compressor, and the complete rotating assembly weighs about a ton. Compression ratio varies from 9 : 1 to 13 : 1 according to altitude, and variable inlet guide vanes and blow-off valves are provided to facilitate engine handling. A cannular-type combustion system is used, each separate flame tube being mounted centrally on a downstream injector. But all tubes merge at their maximum diameter to form an annular secondary region. The turbine is of the five-stage axial-flow type. Mass flow is 62 kg. (137 lb.) sec.

The casing is made in four portions, from sheet steel, and is precision-welded together.

DIMENSIONS.—
Length 6,000 mm. (236.2 in.).
Diameter 1,150 mm. (45.3 in.).
DRY WEIGHT.—
2,300 kg. (5,070 lb.).
PERFORMANCE RATING.—
Max. rating at S/L 12,000 s.h.p. plus 1,200 kg. (2,645 lb.) jet thrust at 9,250 r.p.m.
Max. rating at 11,000 m. (36,000 ft.) 8,000 s.h.p. at 9,250 r.p.m.
FUEL CONSUMPTIONS.—
At max. rating at S/L 0.26 kg. (0.573 lb.) h.p./hr.
At max. rating at 11,000 m. (36,000 ft.) 0.16 kg. (0.353 lb.) h.p./hr.

SWEDEN



The Flygmotor RM2B Ghost turbojet engine with Flygmotor afterburner.

FLYGMOTOR

SVENSKA FLYGMOTOR AB.

HEAD OFFICE AND WORKS: TROLLHÄTTAN.

Svenska Flygmotor AB. holds licences to build the de Havilland Ghost and Rolls-Royce Avon RA.7R engines.

The Flygmotor RM2B, which is in production for the Saab-29F, is manufactured under a D.H. Ghost 50 licence and is fitted with an afterburner designed by the Royal Swedish Air Board in collaboration with Flygmotor.

The Flygmotor RM5 is the licence-built Avon RA.7R which powers the Saab-32A two-seat all-weather fighter, now in production for the Royal Swedish Air Force.

Flygmotor are also building the later 200-Series Avon, under the designation of RM6 and, with reheat, RM6R. Engines of this type power the Saab-32B Lansen and Saab-35 Draken.

THE FLYGMOTOR RM2B GHOST.

The basic engine is built under licence from the de Havilland Engine Co., Ltd. The afterburner, of the short type, is of Swedish design. Structural details of the Ghost will be found under "de Havilland."

DIMENSIONS.—
Diameter 1,346 mm. (53 in.).
Length 3,630 mm. (143 in.).

WEIGHT DRY (with afterburner).—
1,110 kg. (2,450 lb.).

RATINGS.—
Max. static with afterburning 2,800 kg. (6,200 lb.) s.t. at 10,250 r.p.m.
Max. static without afterburning 2,160 kg. (4,750 lb.) s.t. at 10,250 r.p.m.

FUEL CONSUMPTION.—
With afterburning 2.2 kg./kg. s.t./hr. (2.2 lb./lb. s.t./hr.).

OIL CONSUMPTION.—
Normal 0.7 kg./hr. (1.6 lb./hr.).

THE FLYGMOTOR RM2 GHOST.

The RM2 is similar to the RM2B but it is not fitted with an afterburner.

WEIGHT DRY.—
990 kg. (2,185 lb.).

RATING.—
Max. static thrust 2,270 kg. (5,000 lb.) s.t. at 10,250 r.p.m.

THE FLYGMOTOR RM5 AVON.

The RM5 is the Rolls-Royce Avon RA.7R axial-flow turbojet engine built under licence. Full details of the Avon RA.7R will be found under "Rolls-Royce."

STAL

SVENSKA TURBINFABRIKS AB LJUNGSTRÖM (STAL).

HEAD OFFICE AND WORKS: FINSPANG.

The Svenska Turbinfabriks AB Ljungström, which originally formed part of the AB Ljungströms Angturbin (Ljungströms Steam Turbine, Ltd.) began the development of aircraft gas-turbines immediately after the war. A prototype engine named the Skuten (Witch) was exhibited at the Heat and Power Exhibition which was held in Stockholm in October, 1949.

It was followed by a new and higher-powered axial-flow turbojet engine, known as the Dovern, with a take-off rating of 3,300 kg. (7,260 lb.) s.t. at S/L. This engine, which was flight-tested in a converted Avro Lancaster, did not go into production. It has been described fully in earlier editions of "All the World's Aircraft."

Stal is assisting Svenska Flygmotor to develop and manufacture the Rolls-Royce Avon engine in Sweden.

UNITED STATES OF AMERICA

AEROJET

AEROJET-GENERAL CORPORATION (Subsidiary of The General Tire & Rubber Company).

HEAD OFFICE AND WORKS: AZUSA, CALIFORNIA.

BRANCH PRODUCTION WORKS: SACRAMENTO, CAL.

President: Dan. A. Kimball.

Executive Vice-President: A. H. Rude.

Vice-President and General Manager: W. E. Zisch.

Secretary: F. W. Knowlton.

Treasurer: T. S. Clark.

Assistant Secretary and Treasurer: T. E. Beehan.

The Aerojet-General Corporation is the largest industrial organisation in the United States devoted to research, development and manufacture of rocket engines and associated equipment for military and commercial use. Its products include large and small liquid and solid propellent rocket engines for the assisted take-off and in-flight thrust augmentation of piloted aircraft; rocket boosters and primary power plants for missiles; upper atmosphere research rockets; thrust reversers for turbojet engines; auxiliary power units and gas generators; underwater propulsion devices; and ordnance warheads.

Aerojet's type 5KS-4500 solid propellent JATO (jet assisted take-off) units assist the take-off of heavily-loaded carrier-borne aircraft, and type 15KS-1000 units are used as standby power plants on many other military aircraft.

Missile applications of the company's solid-propellent rockets include the boosters on the Chance Vought Regulus, the sustainer motors of the Douglas/Sperry Sparrow and the sustainer motor of the Lockheed Polaris. An Aerojet liquid-propellent sustainer rocket powers the Douglas Nike Ajax anti-aircraft missile.

Aerojet Aerobee upper atmosphere research rockets have been used widely for many years and one of the latest Aerobee-Hi versions attained an altitude of 163 miles (262 km.) over White Sands, New Mexico, in the Summer of 1956. Many more are scheduled to be fired to heights of 180-200 miles (290-320 km.), from an arctic launching facility built by Aerojet engineers at Fort Churchill on Hudson Bay, Canada, during the International Geophysical Year, 1957-58.

It is reported that Aerojet are testing motors developing up to 1,000,000 lb. (453,600 kg.) s.t. from three or four chambers. The company is also developing the second-stage motor for the Project Vanguard earth satellite vehicle.

In April, 1957, Aerojet and D. Napier and Son, Ltd. of England signed an agreement for the exchange of technical information on liquid-propellent rocket engines, in particular those using high test peroxide. Later it was announced that Aerojet had acquired the licence to manufacture in America the Napier Scorpion rocket engine.



Aerojet missile boosters and Jato rockets. From top to bottom: Models 2.2KS-33000, 5KS-4500, 2.2KS-11000, 15KS-1000, 14AS-1000 and (top right) 12AS-250 Junior Jato. Some are no longer in production.

THE AEROJET MODEL 15KS-1000 Mk. 6, Mod. 1 ROCKET.

The 15KS-1000 (1,000 lb.=455 kg. of thrust for 15 seconds) "smokeless" JATO rocket is in full production, and has been delivered to the U.S.A.F. and U.S. Navy.

Prior to the development of the 15KS-1000 unit, the use of JATO was accompanied by a large stream of smoke which trailed behind the aircraft when the unit was fired. In cases where the smoke did not dissipate, due to lack of wind, operations were often affected by the smoke screen created by the first few take-offs. The new smokeless unit, which can operate over a much wider temperature range, gives an extra second of 1,000 lb. thrust with a 25% reduction in weight. The 15KS-1000 unit, which weighs 143 lb. (65 kg.) can be installed on the old type fittings without modification.

This rocket motor has been awarded United States Civil Aeronautics Administration approved Engine Type Certificate No. 249 for airline use on Douglas DC-3, DC-4 and DC-6, and on Convair 240.

THE AEROJET MODEL 5KS-4500 Mk. 7, Mod. 1 ROCKET.

TYPE.—Single-chamber type JATO rocket motor.

PROPELLENT.—Solid type. Comprises solid fuel and oxydiser moulded into cartridge secured in cylindrical steel chamber.

IGNITION.—By electrically-energised glow-plug situated, inside end of nozzle.

DIMENSIONS.—
Diameter 9.38 in. (23.8 cm.).
Overall length 54.6 in. (138.6 cm.).

WEIGHT.—
236 lb. (107 kg.).

PERFORMANCE.—
Rated thrust 4,500 lb. (2,045 kg.).
Rated duration 5 sec.
Total impulse 22,500 lb. (10,215 kg.) per sec.

THE AEROJET MODEL AJ10-24 BOOSTER ROCKET ENGINE.

TYPE.—Liquid bi-propellent rocket, gas or chemically-pressurised. Used to propel the Aerobee research rocket.

CONSTRUCTION.—Assembly consists of a cylindrical section which contains the oxidiser, fuel and pressurising tanks. The pressure regulator and rocket motor are attached to the tank section of the Aerobee.

DIMENSIONS.—
Diameter 15 in. (38.10 cm.).
Length 130 in. (330.2 cm.).

ALLISON

THE ALLISON DIVISION, GENERAL MOTORS CORPORATION.

HEAD OFFICE AND WORKS: INDIANAPOLIS 6, IND.

General Manager: E. B. Newill.

Assistant General Manager: Harold H. Dice.

Director of Engineering: Dimitrius Gerdan.

Manufacturing Manager for Aircraft Engines Operations: Harold R. Laubach.

The Allison Division of the General Motors Corporation delivered its 100,000th aero-engine early in 1956. About 70% of these were V-1710 piston-engines. The remainder were mostly J33 and J35 turbojets of General Electric design, and by the beginning of 1956 more than seven million flying hours had been accumulated by Allison turbine engines.

An important part of the company's work has been the development of the short-life J33-A-37 centrifugal-flow turbojet for missile applications, and this engine continues in production, together with the new J71 axial-flow turbojet. Also in production is the T56 turboprop, which powers the Lockheed C-130A transport. A variant of the T56, designated Allison Model 501, has been ordered for commercial usage in the Lockheed Electra transport.

The T40 dual-power-section turboprop, although no longer in production, powers the Convair R3Y Tradewind four-engined transport flying-boat and the Convair XFY-1 experimental VTO aircraft.

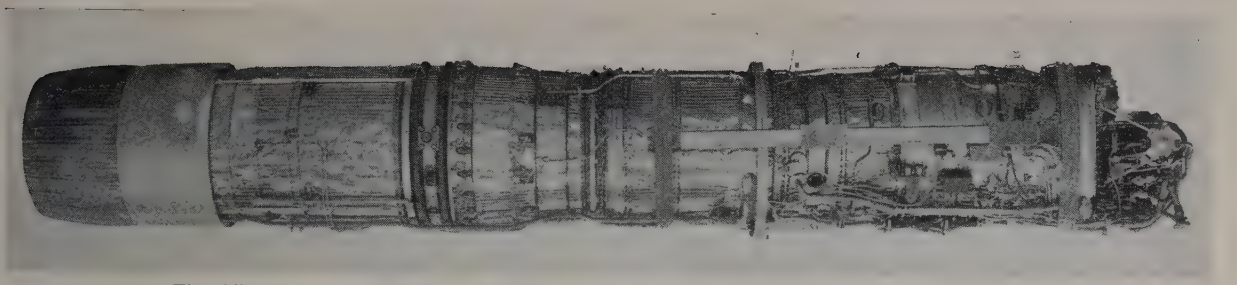
It was announced in March, 1955 that Allison had begun a four-year constructional programme to build extensive new research, development and testing facilities for advanced gas-turbines at its Maywood, Indiana, works.

In addition, a small factory to handle minor overhaul of the Model 501 turboprop and assembly and repair of Aeroproducts 606 airscrews, as specified for the Lockheed Electra transport, has been opened in Burbank, California, near the Lockheed factory.

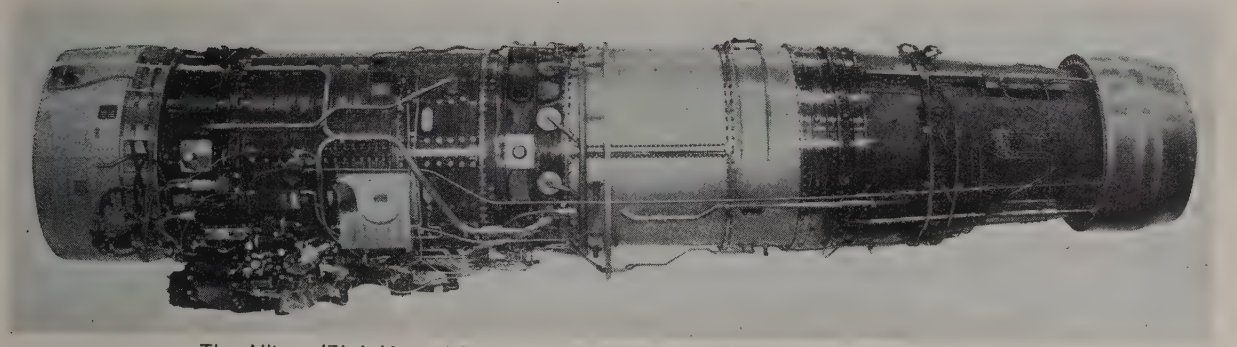
THE ALLISON J71 SERIES.

The J71 is a completely new engine embodying a number of notable changes in design.

A new combustion system incorporates what Allison calls a "cannular" burner section, in which ten individual combustion chambers are enclosed in a large outer annular type chamber. After compression and ignition in the outer chamber the mixture is bled into the inner



The Allison J71-A-2 turbojet engine with afterburner (14,000 lb.=6,350 kg. s.t. maximum).



The Allison J71-A-11 axial-flow turbojet engine (10,200 lb.=4,625 kg. s.t. maximum).

"cans" where, in effect, the mixture is re-heated.

The J71 has sixteen stages of compression and a three-stage turbine, and it is fully equipped for all-weather operation. Hot air can be bled from the compressor to the air-inlet vanes and central "bullet" and automatically retractable air inlet screens are provided. An automatic ice-detector is also supplied. The air inlet screens and the variable-area jet nozzle are hydraulically operated by the engine's own independent hydraulic system. It also has its own integral oil system.

Incorporation of a Minneapolis-Honeywell electro-hydraulic control system makes the J71 largely self-protecting and automatic in operation.

The J71 has passed the official U.S.A.F. qualification test with a demonstrated thrust exceeding 10,000 lb. (4,540 kg.) at 6,100 r.p.m., with a fuel consumption of 0.8 lb./hr./lb. s.t. (0.8 kg./hr./kg. s.t.).

The following versions of the J71 have so far been announced :—

J71-A-2. Powers McDonnell F3H-2N Demon. Fitted with afterburner to give maximum thrust of 14,000 lb. (6,350 kg.).

J71-A-4. Version with short afterburner for prototypes of Martin XP6M-1 SeaMaster flying-boat. Maximum thrust 13,000 lb. (5,900 kg.).

J71-A-7. Development of J71-A-2 also with afterburner.

J71-A-11. Powers Douglas RB-66B twin-jet reconnaissance-bombers. Maximum thrust 10,200 lb. (4,625 kg.).

All further details are classified except for the following :—

DIMENSIONS (J71-A-2).—
Diameter 42 in. (1,067 mm.).
Length, with extension pipe 284.6 in. (7,230 mm.).

DIMENSIONS (J71-A-11).—
Diameter 47.6 in. (1,209 mm.).
Length, with extension pipe 191 in. (4,850 mm.).

WEIGHT (J71-A-2).—
With accessories 4,869 lb. (2,208 kg.).

WEIGHT (J71-A-11).—
With accessories 4,090 lb. (1,855 kg.).

THE ALLISON T56.

The T56 turboprop was evolved from Allison's original T38 engine and was first flown in the nose of a B-17 test bed in 1954. Later two Convair YC-131C transports were each fitted with two YT56 engines, rated at 3,250 h.p., and these aircraft completed 3,000 hours of development flying with the 1,700th M.A.T.S. Squadron between May and December, 1955.

By October, 1956, T56 turboprops had accumulated 45,000 test hours and 16,000 flying hours. Two production versions have been announced.

T56-A-1. Powers the Lockheed C-130A transport aircraft.

T56-A-2. Ordered by the U.S. Navy for possible helicopter application.

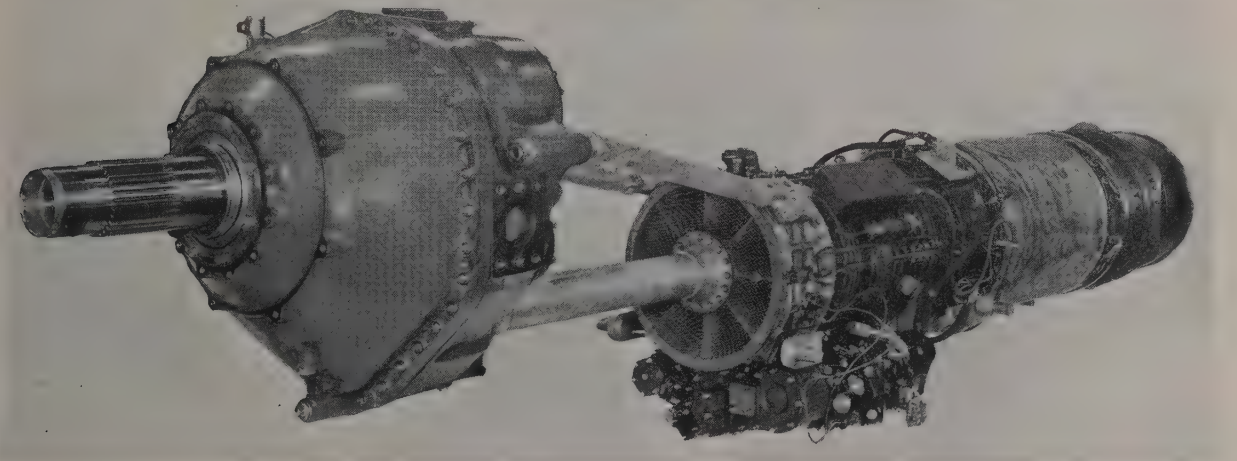
TYPE.—Turboprop with 14-stage axial-flow compressor and 4-stage turbine.

AIRSCREW DRIVE. — Combination spur/planetary gear type, primary step-down by spur (3.125 : 1), secondary by planetary (4.0 : 1). Overall gear ratio 12.5 : 1. Power section r.p.m. 13,820, airscrew shaft r.p.m. 1,106. Cast magnesium reduction-gear housing. Gearbox assembly supported from power section by main drive shaft casing 28 in. (71 mm.) long and two inclined struts. Weight of gearbox assembly approximately 450 lb. (204.3 kg.) with pads on rear face for accessory mounting.

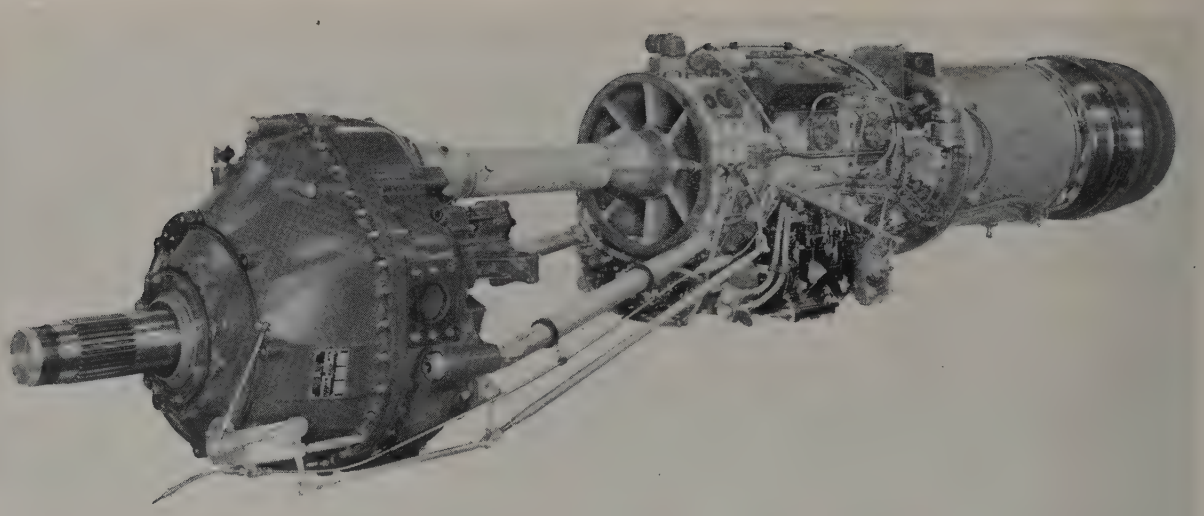
AIR INTAKE.—Circular duct on engine face. Thermal de-icing. Inlet air flow 32.5 lb./sec. (14.75 kg./sec.).

COMPRESSOR. — Fourteen-stage axial-flow. Series of fourteen discs with rotor blades dovetailed in peripheries and locked by adjacent discs. Rotor assembly tie-bolted to shaft which runs on one ball and one roller type bearings. Fifteen rows of stator blades, welded in rings. Disc, rotor and stator blades and two-piece welded casing of stainless steel. Compressor inlet area 155.65 sq. in. (1,004 cm.²). Compression ratio 9.25 : 1. Mass air flow 32.5 lb./sec. (14.75 kg./sec.).

COMBUSTION CHAMBERS.—Six stainless steel cannular-type perforated combustion liners within one-piece stainless steel outer casing.



The 3,750 e.s.h.p. Allison T56-A-1 turboprop engine.



The 3,750 e.s.h.p. Allison Model 501-D13 turboprop engine, the civil version of the T56.

Fuel nozzles in forward end of each combustor liner. Primary ignition by two igniters in diametrically-opposite combustors.

FUEL SYSTEM.—High-pressure type. Bendix control system.

FUEL GRADE.—Mil-F-5624B Grade JP-4, or Gasoline Grade 100/130.

NOZZLE GUIDE VANES.—Seventy-eight solid cast GMR-235 steel alloy guide vanes.

TURBINE.—Four-stage. Rotor assembly consists of four stainless steel discs, first three with cast GRM-235 blades and the fourth with forged S-816 blades, all secured in peripheries of discs by "fir-tree" roots. Discs splined to rotor shaft which runs on front and rear roller bearings. Steel outer turbine casing. Gas temperature before turbine 1,780°F.

JET PIPE.—Fixed. Stainless steel.

ACCESSORY DRIVES.—Accessory pads on rear face of reduction-gear housing at front end of engine.

LUBRICATION SYSTEM.—High pressure. Dry sump. Pesco dual-element oil pump. Normal oil supply pressure 180-200 lb./sq. in. (12.6-14 kg./cm.²).

OIL SPECIFICATION.—Mil-L-7808.

MOUNTING.—Three-point suspension.

STARTING.—Air turbine, gear-box mounted.

DIMENSIONS.—
Width 27.5 in. (698.5 mm.).
Height 40 in. (1,016 mm.).
Length 145.1 in. (3,685.5 mm.).

WEIGHT.—
With accessories 1,645 lb. (746.8 kg.).

PERFORMANCE RATINGS (T56-A-1).—
Take-off 3,750 equivalent s.h.p.
Normal 3,375 equivalent s.h.p.

CONSUMPTION.—
Fuel 0.540 lb./h.p./hour (0.245 kg./h.p./hour) at 3,750 e.s.h.p. S/L. static.

THE ALLISON MODEL 501.

The Model 501 is the commercial version of the T56 turboprop, and has been chosen to power the Lockheed Electra transport. 75% of the components in the two engines are interchangeable. Changes compared with the T56 are the introduction of a new compressor casing consisting of four forged quadrants bolted permanently together, repositioning of the reduction gear to below the power section and provision for operating on kerosene fuel.

On May 20, 1955, the Model 501 was awarded Type Certificate No. 282 by the C.A.A. and so became the first U.S. turboprop approved for commercial operation. Two versions have been announced :—

Model 501-D13. Initial version for the Electra, for service in 1958. Reduction gear ratio 13.54 : 1, primary step-down by spur (3.13 : 1), secondary by planetary (4.33 : 1). Rated at 3,460 s.h.p. plus 726 lb. (329 kg.) jet thrust (3,750 e.h.p.) for take-off. Two Model 501-D13's installed in Allison's Convair-Liner flying test-bed for initial flight testing, including airscrew icing trials. Another installed in the starboard outer engine position of the prototype Super Constellation in February, 1957 for testing under airline operating conditions.

Model 501-D15. Developed version for service in 1959. Inlet guide vanes removed to increase air mass flow. First two rows of turbine blades shrouded. Rated at 4,050 e.h.p.

DIMENSIONS (Model 501-D13).—
Width 27 in. (686 mm.).
Height 36 in. (914 mm.).
Length 145.2 in. (3,688 mm.).

WEIGHT (Model 501-D13).—
Dry, with accessories 1,750 lb. (794 kg.).

PERFORMANCE (Model 501-D13).—
Take-off 3,460 s.h.p. plus 726 lb. (329 kg.) jet thrust at 13,820 r.p.m.
Max. continuous 3,094 s.h.p. plus 702 lb. (318 kg.) jet thrust at 13,820 r.p.m.
Max. cruising 1,850 s.h.p. plus 145 lb. (66 kg.) jet thrust at 13,820 r.p.m. at 406 m.p.h. (653 km.h.) at 25,000 ft. (7,620 m.).

FUEL CONSUMPTIONS (Model 501-D13).—
Take-off rating 0.54 lb./h.p./hr. (0.245 kg./h.p./hr.).
Max. continuous rating 0.552 lb./h.p./hr. (0.25 kg./h.p./hr.).
Max. cruising rating 0.458 lb./h.p./hr. (0.208 kg./h.p./hr.).

THE ALLISON MODEL 550.

Dimensionally similar to the Model 501, the Allison Model 550 will be a two-spool turboprop of advanced design for service after 1960. Compression ratio will be about 13 : 1 and the rated power not less than 5,000 e.h.p., with a fuel consumption of about 0.385 lb./h.p./hr. (0.176 kg./h.p./hr.).

THE ALLISON T40.

The T40, which was developed for the U.S. Navy, consists of two T38 axial-flow power sections driving two Aeroproducts three-blade co-axial contra-rotating airscrews through a common reduction gear. The power sections are connected together so that in effect they form a single unit and are connected to the reduction gear by extension shafts. Each power section can operate the contra-rotating airscrews independently or together.

The T40 engine, which is currently rated at 5,850 e.s.h.p., powers the Convair R3Y-1 and R3Y-2 Tradewind four-engined transport flying-boats which are in service with the U.S. Navy.

A YT40-A-14 powered the Convair XFY-1 experimental vertical take-off aircraft and a special XT40-A-1, with afterburner, was fitted in the Republic XF-84H research fighter.

The T40 is no longer in production.

THE ALLISON J33 SERIES.

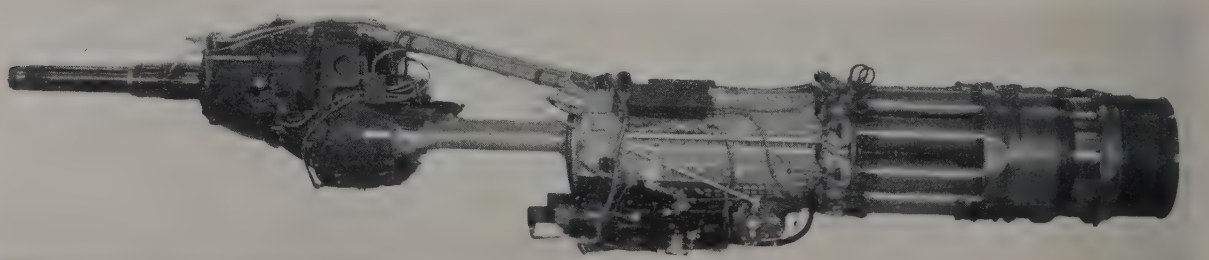
The latest models in the J33 Series are :—

J33-A-18A. Powers the Chance Vought Regulus I surface-to-surface missile.

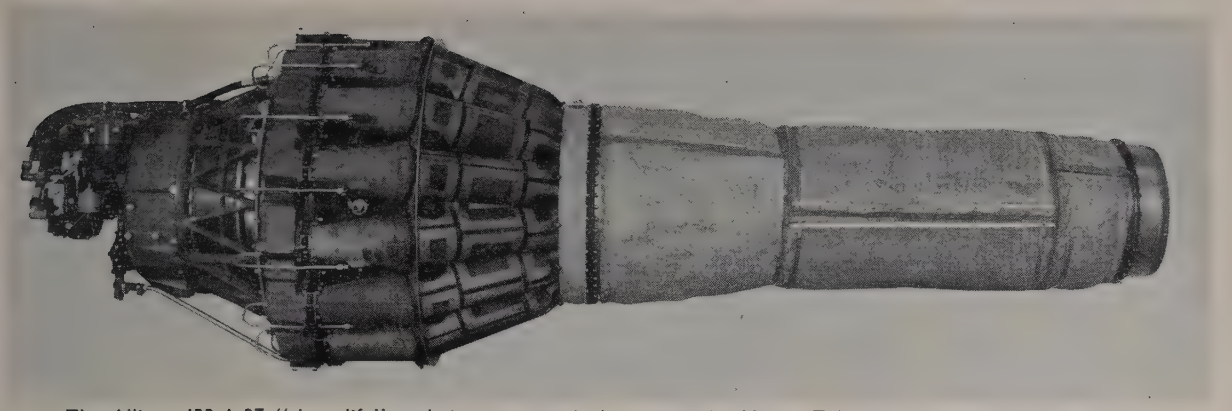
J33-A-22. Has compressor bleeds for airframe boundary-layer control. Powers the Lockheed T2V-1.

J33-A-35. Powers Lockheed T-33A and TV-2. This version out of production.

J33-A-37. Powers the Martin TM-61 and TM-76 Matador missiles. Short-life engine with reduced number of components in accessories section. It has no air inlet screens and an elongated one-piece exhaust cone-tailpipe. 85% reduction in use of critical materials which, with elimination of components not needed in an expendable engine, results in 30% reduction in cost.



The 5,850 e.s.h.p. Allison T40-A-6 turboprop engine.



The Allison J33-A-37 "short-life" turbojet engine which powers the Martin TM-61 and TM-76 tactical missiles.

TYPE.—Centrifugal-flow turbojet.

AIR INTAKE.—Circular air inlet with annular duct leading to impeller eye of compressor. Inlet air flow 87 lb./sec. (39.5 kg./sec.).

COMPRESSOR. — Single - stage double - entry centrifugal-flow, with double-sided impeller having on each side seventeen vanes. Diffuser has fourteen tangential outlets and terminal elbows leading to combustion chambers. Impeller assembly runs on one ball and one roller bearing, the shaft being coupled through flexible spline to turbine shaft. Compression ratio 4.25 : 1. Mass air flow 87 lb. (39 kg.) per sec. at sea level static thrust rating.

COMBUSTION CHAMBERS.—Fourteen straight-through combustion chambers with internal concentrically-mounted perforated flame tubes, each containing at its front end a fuel atomiser. Chambers are interconnected to permit flame spread during starting cycle. Igniter plugs in chambers 7 and 14.

FUEL SYSTEM.—Double manifold type. Pesco dual injection pump delivers fuel to burners through Bendix flow control units. Maximum fuel pressure 40 lb./sq. in. (2.8 kg./cm.^{2}).

FUEL GRADE.—JP-4 (MIL-F-5624) or Gasoline (100/130 Grade).

NOZZLE GUIDE VANES.—Forty-eight cast steel nozzle guide vanes inserted in periphery of steel diaphragm.

TURBINE.—Single-stage axial-flow comprising fifty-four solid alloy steel blades inserted in stainless-steel rotor disc, shaft of which runs on one ball and one roller bearing. Maximum allowable temperature after turbine 1,320°F.

JET PIPE.—Stainless steel jet pipe with fixed inner cone.

AUXILIARY DRIVE.—Engine accessories, including fuel and oil pumps, mounted on wheelcase at front of engine.

LUBRICATION SYSTEM.—Wet sump. Gear pump supplies pressure oil to main bearings. Normal oil supply pressure 42 lb./sq. in. (2.95 kg./cm.^{2}). Integral oil tank with capacity for 3 U.S. gallons (11.3 litres).

OIL SPECIFICATION. — Mil - O - 6081 (Grade 1010).

STARTING.—Direct-drive electric starter to spin rotating assembly. Igniter plugs in two combustion chambers energised by two Scintilla transformers. Shielded.

DIMENSIONS (J33-A-18A and J33-A-35).—
Diameter 50.5 in. (1,283 mm.).
Overall length 107 in. (2,717 mm.).

DIMENSIONS (J33-A-37).—
Diameter 49$\frac{5}{8}$ in. (1,252 mm.).
Overall length 159.5 in. (4,051 mm.).

WEIGHTS (Dry).—
J33-A-18A and J33-A-37 1,790 lb. (812.6 kg.).
J33-A-35 1,820 lb. (826.3 kg.).

PERFORMANCE RATINGS (J-33A-18A and35).
Military 4,600 lb. (2,088 kg.).
Normal 3,900 lb. (1,770 kg.).

PERFORMANCE RATINGS (J33-A-37).—
Continuous max. 4,600 lb. (2,088 kg.).

CONSUMPTIONS (J33-A-18A, 35 and 37).—
Fuel 1.14 lb./hr./lb. s.t. (1.14 kg./hr./kg. s.t.) military, 1.12 lb./hr./lb. s.t. (1.12 kg./hr./kg. s.t.) normal.
Oil 2.2 lb. (1.0 kg.) per hour military, 1.18 lb. (0.53 kg.) per hour normal.

THE ALLISON J35.

More than 14,000 engines of the basic J35 type were built by Allison before production ended in the summer of 1955, and many remain in service. In particular, the J35-A-35 powers the later versions of the Northrop F-89 Scorpion.

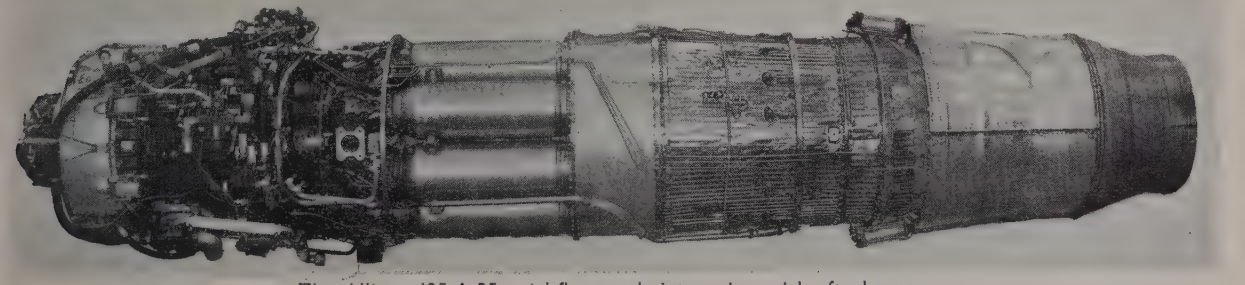
The J35-A-35 is an axial-flow turbojet engine, with an eleven-stage compressor, eight tubular straight-through combustion chambers and a single-stage turbine. A full structural description of it appeared in the 1956-57 edition of "All the World's Aircraft."

DIMENSIONS.—
Diameter (across afterburner) 43 in. (1,092 mm.).
Overall length including afterburner 195.5 in. (4,965 mm.).

WEIGHT.—
Dry 2,315 lb. (1,051 kg.).
With accessories 2,930 lb. (1,330 kg.).

PERFORMANCE RATINGS.—
Military (with afterburner) 8,000 lb. (3,632 kg.).
Military (without afterburner) 5,450 lb. (2,474 kg.).
Normal (with afterburner) 7,200 lb. (3,270 kg.).
Normal (without afterburner) 4,855 lb. (2,204 kg.).

CONSUMPTIONS (without afterburner).—
Fuel 1.10 lb./hr./lb. s.t. (1.10 kg./hr./kg. s.t.) military, 1.08 lb./hr./lb. s.t. (1.08 kg./hr./kg. s.t.) normal.
Oil not more than 3 lb. (1.36 kg.) per hour.



The Allison J35-A-35 axial-flow turbojet engine with afterburner.

BOEING

BOEING AIRPLANE COMPANY, INDUSTRIAL PRODUCTS DIVISION.

HEAD OFFICE AND WORKS: SEATTLE 14, WASH.

Officers: See under "Boeing" on page 253.

In 1943, when the U.S. Army Air Forces became interested in the possibilities of using gas-turbines in large aircraft, the Boeing company decided to initiate its own propulsion research programme and a jet-propulsion laboratory was set up in the main plant at Seattle as a pure research project with the object of evaluating all data on gas-turbines. Later, the decision was made to build various turbine components and to evaluate them separately.

Axial-flow and centrifugal compressors and other components were built. Design studies progressed to the point where the original research project was expanded to embrace the complete assembly of experimental power-units, culminating in the design of many other small gas-turbines which are now being built in experimental and production quantities.

The first to run was the Boeing Model 500, a two-burner turbojet developing 140 lb. (63.5 kg.) thrust at 36,000 r.p.m. This engine is suitable as a starter engine for larger jets or turbines, and may also be used as a thrust source for missiles, glide-bombs and small aircraft.

The other engines make use of the gas-producing section of the Model 500 and have been adapted for shaft-drive on the Model 502-10C, or compressed-air output on the Model 502-11B. The Boeing 502-10C gas turbine engine is a development of the earlier production engine, the Model 502-2E. The 502-11B is a development of the 502-7D with increased air-horsepower output and is used in a starter unit developed for the support of the Boeing B-52 eight-jet bomber.

More than 500 Model 502 engines have been produced, including an unspecified number which have been supplied to the U.S. Navy Bureau of Ships to power generators in minesweeping vessels and to propel landing craft. Model 502 engines have also been used experimentally to power personnel boats, light aircraft, helicopters, road trucks, railway shunting locomotives and stationary pumps and generators.

Details of these engines have appeared in previous editions of "All the World's Aircraft."

CONTINENTAL

CONTINENTAL AVIATION AND ENGINEERING CORPORATION, GAS TURBINE DIVISION.

HEAD OFFICE AND WORKS: 12700, KERCHEVAL AVENUE, DETROIT 15, MICHIGAN.

President: C. J. Reese.

Executive Vice-President and General Manager: A. W. Wild.

Secretary: Frederick H. Faust.

Treasurer: H. M. Parker.

Continental Aviation and Engineering Corporation, a subsidiary of Continental Motors Corporation, was formed in 1940 to serve as a research and development division of Continental Motors. It holds a licence to manufacture the French Turbomeca range of gas turbine engines.

THE CONTINENTAL MODEL 352.
U.S. Air Force designation: J69-T-9.

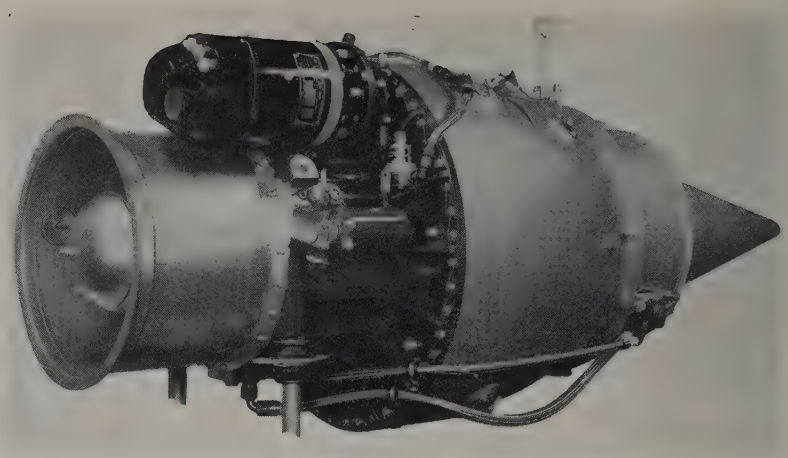
The J69 is basically the Turbomeca Marboré II which has been developed to meet American requirements. The J-69-T-9 version is a "long-life" engine and is in production for installation in the Cessna T-37 jet trainer, and is also fitted to the Beechcraft Jet Mentor and Temco TT-1 Pinto trainers.

The J69, which produces about 4 per cent. more thrust than the French engine, has provision for the installation of American accessories of larger types than are used on the Marboré II.

For a general description of the Marboré II see under "Turbomeca" (France).

DRY WEIGHT.—
364 lb. (165·2 kg.).

RATINGS.—
Take-off 920 lb. (420 kg.) s.t. at 22,700 r.p.m.
Normal output 725 lb. (330 kg.) s.t. at 21,000 r.p.m.
90 per cent. normal output 650 lb. (295 kg.) s.t. at 20,300 r.p.m.



The Continental Model 354 (J69-T-19A Lightweight turbojet engine.

THE CONTINENTAL MODEL 354.
U.S. Air Force designation: J69-T-19A.

The J69-T-19A is similar to the Model 352 but is a "short-life" engine intended for missile and target drone installations. It powers the Ryan Q-2A Firebee drone. The basic differences between the Models 352 and 354 concern accessories and their arrangement.

DRY WEIGHT.—
317 lb. (143.9 kg.).

RATINGS.—
Take-off 1,060 lb. (481 kg.) s.t.
Normal 860 lb. (390 kg.) s.t.

FUEL CONSUMPTIONS.—
Take-off 1.27 lb./lb. s.t./hr. (1.27 kg./kg. s.t./hr.).
Normal 1.25 lb./lb. s.t./hr. (1.25 kg./kg. s.t./hr.).

THE CONTINENTAL MODEL 141.

The Model 141 is a gas-turbine-driven air generator which has been developed from the Turbomeca Palouste. It is embodied in a trailer-mounted unit (U.S.A.F. MA-1A) for ground starting of jet aircraft; but is suitable also for installation in pressure-jet helicopters and has been chosen for this application in experimental and projected designs.

WEIGHT.—
197 lb. (89.35 kg.).

PERFORMANCE.—
Air h.p. (standard conditions) 191.
Air h.p. (130°F. air temperature) 182.
Air delivery (standard conditions) 2.2 lb./sec. (0.99 kg./sec.).
Air delivery pressure (standard conditions) 52.5 lb./sq. in. (3.69 kg./cm.²).

CONSUMPTION.—
Fuel 287 lb./hr. (130 kg./hr.).

THE CONTINENTAL MODEL 160.

Model 160 is the Continental designation for the Turbomeca Autan turbo-compressor, which is scheduled for further development and application by Continental. For a full description see under "Turbomeca" (France).

THE CONTINENTAL MODEL 210.
U.S. Air Force designation: XT51-T-1.

Developed from the Turbomeca Artouste I, this 280 h.p. shaft turbine has been installed experimentally in the Bell XH-13F helicopter and the Cessna XL-19C liaison aircraft.

THE CONTINENTAL MODEL 220-2.
U.S. Air Force designation: XT51-T-3.

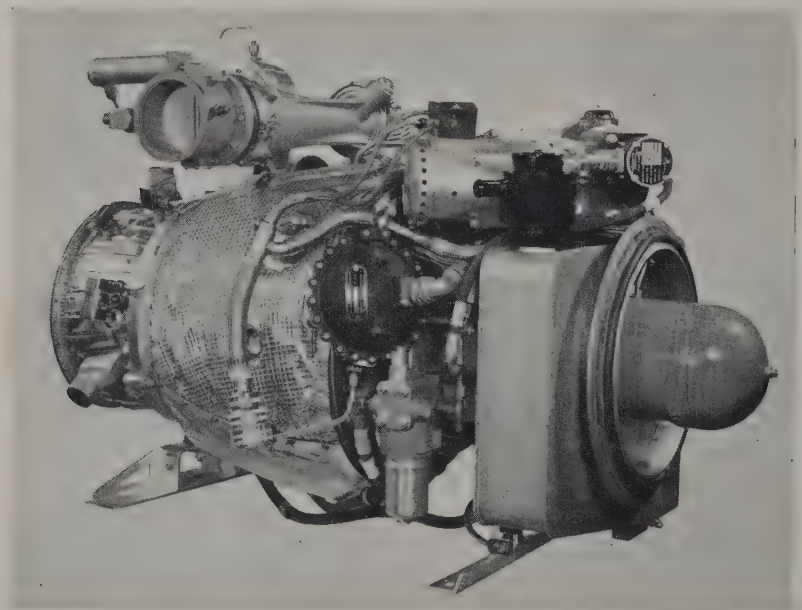
This 425 h.p. shaft turbine is a development of the Turbomeca Artouste II, and has been installed experimentally in the Sikorsky XH-39 helicopter.

THE CONTINENTAL MODEL 320.

Pending new applications and development, the Model 320 turbojet engine (330 lb.=150 kg. s.t.) remains similar to the Turbomeca Palas, of which a description appears under "Turbomeca" (France).

THE CONTINENTAL MODEL 324.

Pending new applications, the Model 324 turbojet engine (550 lb.=250 kg. s.t.) remains basically the same as the Turbomeca Arbizon, of which a description appears under "Turbomeca" (France).



The Continental Model 141 air generator.

FAIRCHILD

FAIRCHILD ENGINE DIVISION, FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

ENGINE DIVISION, HEAD OFFICE AND WORKS: DEER PARK, LONG ISLAND, N.Y.

OTHER WORKS: VALLEY STREAM, LONG ISLAND, N.Y.

Vice-President and General Manager: George F. Chapline.

Assistant General Manager: E. M. Lester.

Director of Engineering: E. D. Bryant.

Chief Engineer: A. T. Gregory.

The Fairchild Engine Division is engaged in considerable power-plant research and development work for the United States Air Force and the United States Navy Bureau of Aeronautics and the Bureau of Ordnance.

This work includes the development and production of gas-turbine engines for both piloted and pilotless aircraft and guided missiles, and design and development work on other high-performance lightweight engines. In addition, Fairchild is producing in quantity major components of the General Electric J47 turbojet engine and is manufacturing the V-32 D-2 auxiliary power-plant, comprising a reciprocating engine and generator, which is used in virtually every American military aircraft in the bomber and transport classes.

The Engine Division is also engaged in extensive research and development in small gas-turbine power-plants and has an advanced turbine laboratory, plus a supersonic combustion laboratory to support this work.

The only recent Fairchild aero-engines of which brief details may be given are the J44 turbojet which is being produced for both the U.S. Navy and Air Force, and the XJ83 small lightweight high-performance jet engine for the U.S.A.F.

THE FAIRCHILD XJ83.

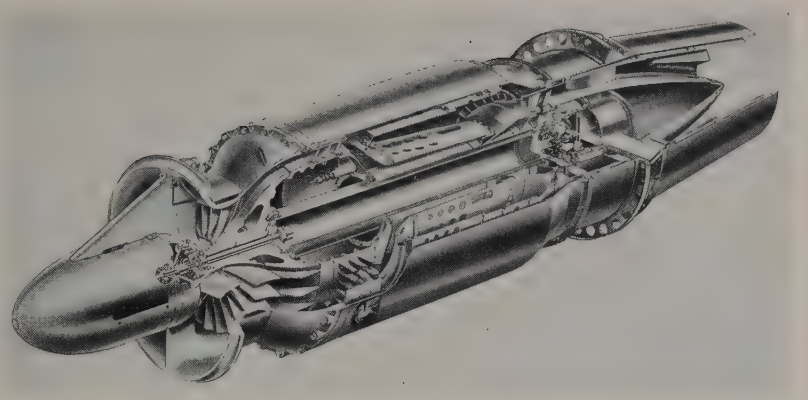
The XJ83 in its initial form is an entirely new high-performance small turbojet in the 2,000 lb. (908 kg.) s.t. class and is intended to power piloted aircraft as well as missiles. The thrust/weight ratio potential is said to be in the neighbourhood of 10 to 1.

THE FAIRCHILD J44.

The J44 is a small lightweight general-purpose turbojet engine which was designed originally to a 1947 U.S. Navy specification. Primarily it is intended to power target drones and guided missiles, and its first announced use was as the power-plant of the Ryan Firebee high-speed pilotless target aircraft. It now powers Fairchild's own Petrel AUM missile, and has been developed to the stage where it is also suitable for use in piloted aircraft. Thus, the Bell VTOL vertical take-off aircraft which first flew in 1954 was powered by two J44 engines, while a Fairchild C-123B has been fitted with two J44 auxiliary jet engines at the wing-tips for evaluation trials.

The J44, which is designed to be a self-contained power-plant needing only a minimum of services from the airframe, features an outer sheet metal monocoque shell which forms both a pressure chamber and a frame structure connecting the two main bearing supports. Its smooth outer shell, which carries the main stresses of the engine, eliminates the need for additional cowling in certain types of installations.

The J44 is the first jet engine in its power and weight class to receive an Approved Type Certificate from the Civil Aeronautics Administration. Its commercial designation is FT-101E.



A cut-away drawing of the Fairchild J44 turbojet engine.

Two versions of the J44 have so far been announced :—

J44-R-3. Original production version.

J44-R-20. Developed "long-life" version, with stainless steel combustion chambers and nozzle guide vanes. Reduced weight.

TYPE.—Lightweight turbojet.

AIR INTAKE.—Annular type surrounding nose bullet.

COMPRESSOR.—Mixed-flow type. Single-sided impeller with 22 vanes, made in two parts with forged aluminium front half and forged magnesium rear half. Impeller bolted to shaft which is carried on ball bearings. Cast aluminium casing.

COMBUSTION CHAMBER.—Annular type, made of inconel on J44-R-3 and stainless steel on J44-R-20.

IGNITION.—Dual coil and igniters on J44-R-3. Single coil and igniter on J44-R-20.

FUEL SYSTEM.—Maximum fuel pressure 30 lb./sq. in. (2.11 kg./cm.²).

FUEL GRADE.—JP fuels or gasoline.

NOZZLE GUIDE VANES.—Thirty-seven Stellite 21 vanes and inconel bands (J44-R-3). Stainless steel bands and vanes (J44-R-20).

TURBINE.— Single-stage turbine. Forged steel alloy disc bolted to shaft which runs on a rear roller bearing in the J44-R-3 and a rear ball bearing on the J44-R-20. Forty-six AMS-2645 (J44-R-3) or AMS-5382 (J44-R-20) blades welded to periphery of disc. Gas temperature aft of turbine 1,500°F. (815.6°C.) maximum.

JET PIPE.—Fixed type. AMS-5542 steel cone. Stainless steel jet pipe.

ACCESSORIES. — Self-contained accessory section in nose bullet, containing fuel pump, starter, electric generator and tachometer drive. Can be quickly removed or replaced, or individual accessories can be removed from their mounting pads, only one special tool—a shaft-nut wrench—being required for all accessory servicing.

LUBRICATION.—Front and rear bearings lubricated by oil mist system, accessories section by oil sump. Capacities : oil mist 400 cc., accessories section 350 cc. Operating pressure 0.35 lb./sq. in. (0.025 kg./cm.²).

OIL SPECIFICATION.—Land operation MIL-O-6081 GR 1010. Overwater operation MIL-C-6629 Type III.

MOUNTING.—Cantilever or single-point trunnion mounting.

STARTING.—Jack and Heintz D62-1 electric starter.

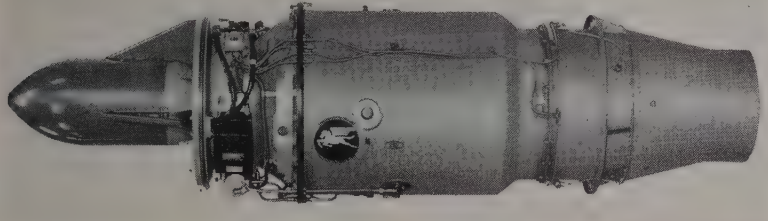
DIMENSIONS.—
Diameter 22.0 in. (559 mm.).
Length (J44-R-3) 95.6 in. (2,428 mm.).
Length (J44-R-20) 88.42 in. (2,246 mm.).
Frontal area 2.724 sq. ft..

WEIGHTS (J44-R-3).—
Dry 370 lb. (167.8 kg.).
Complete with accessories 416.2 lb. (189 kg.).

WEIGHTS (J44-R-20).—
Dry 335 lb. (152 kg.).
Complete with accessories 391 lb. (178 kg.).

PERFORMANCE RATING.—
Static thrust 1,000 lb. (454 kg.) at 15,780 r.p.m.

CONSUMPTIONS.—
Fuel (J44-R-3) 1.55 lb./lb. thrust/hr. (1.55 kg./kg. thrust/hr.).
Fuel (J44-R-20) 1.5 lb./lb. thrust/hr. (1.5 kg./kg. thrust/hr.).
Oil 0.625 lb./hr. (0.283 kg./hr.).



The Fairchild J44 Lightweight turbojet engine.

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY. AIRCRAFT GAS TURBINE DIVISION.
HEAD OFFICE : CINCINNATI 15, OHIO.

Vice-President and General Manager : J. S. Parker.
Counsel : C. F. Steele.

Jet Engine Department.
General Manager : G. Neumann.

Evendale Operating Department.
General Manager : J. B. Montgomery.

Flight Propulsion Laboratory Department.
General Manager : D. Cochran.

Small Aircraft Engine Department (Lynn, Mass.).
General Manager : G. C. Shafer.

Aircraft Accessory Turbine Department (Lynn, Mass.).
General Manager : W. C. O'Connell.

The General Electric Company entered the gas-turbine field about 1895. Years of pioneering effort by the late Dr. Sanford A. Moss produced the aircraft turbo-supercharger, successfully tested at height in 1918 and mass-produced in World War II for U.S. fighters and bombers.

The company built its first aircraft gas-turbine in 1941, when it began development of Whittle-type turbojets, under an arrangement between the British and American Governments.

Since that time, General Electric has produced a series of successful designs. Production and development responsibility for two of them, the J33 and J35, was transferred to the Allison Division of General Motors after the war.

Of the others, the J47 powers the Boeing B-47 and RB-47, North American F-86D, F-86E, F-86F, F-86K, F-86L and FJ-2, and the Convair B-36 ; and the J-73 powers the F-86H. Production of both the J47 and J73 was completed early in 1956.

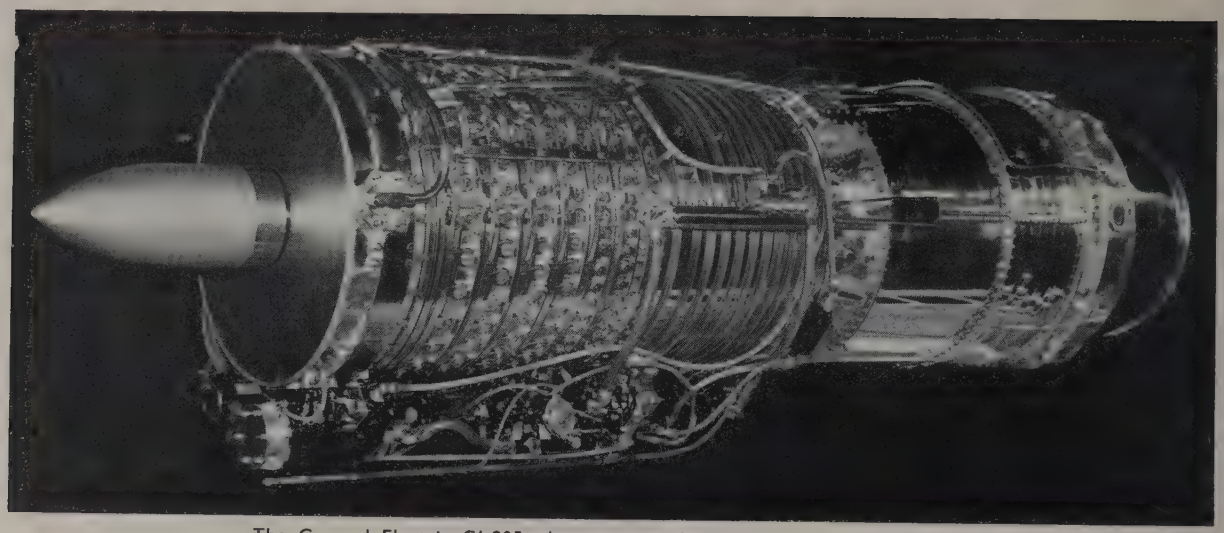
General Electric's current production engine is the J79, with the T64, T58, XJ85 and a series of rocket motors under development. The J79 powers the Lockheed F-104, Convair B-58, Grumman F11F-1F and the Chance Vought Regulus II missile. A commercial version designated the CJ-805, will power the Convair 880 transport.

The new T58 small free-turbine engine is scheduled for flight testing in Sikorsky S-58 and Vertol H-21 helicopters and will power the Kaman HU2K-1 utility helicopter.

In 1952 an Aircraft Accessory Turbine Department was established to handle the development, manufacture and sale of aircraft turbine accessory equipment. Its current products include air turbine drives and hydraulic turbo-pumps for the Boeing B-52, turbo-starters for the Martin B-57, afterburner fuel pumps for the North American F-86D, and turbo-superchargers for many civil and military aircraft.

In November, 1951, General Electric established a Development Operation within its Aircraft Gas Turbine Division. Later, this operation became the Development Department, which, in 1956, was renamed the Flight Propulsion Laboratory Department, one of five Departments making up the AGT Division.

The Flight Propulsion Laboratory is not committed to providing support for the current line of production engines. It is responsible for creating new concepts of flight propulsion, to demonstrate the feasibility of new materials and components and, as required, to demonstrate new



The General Electric CJ-805, the commercial version of the J79 turbojet.

and complete propulsion systems. Ordinarily, the Department is concerned with components and systems well in advance of production. After it has demonstrated the feasibility of new product lines, these are transferred to the appropriate product Departments for manufacture in quantity.

The Department has extensive research and development facilities both at Evendale, Ohio and Lynn, Mass., for doing applied research, developing new materials and demonstrating new engineering principles. It creates and operates major development test facilities for the Division and supports the other Departments by carrying out assigned engineering and other tasks.

Currently, the Flight Propulsion Laboratory is investigating air-breathing engines for high Mach numbers, advanced rocket engines, and engines for special purposes, such as VTOL and STOL aircraft. The rocket engines include thirteen X-405 liquid bi-propellent motors for the "Project Vanguard" earth satellite rockets.

THE GENERAL ELECTRIC XJ85.

Originally designated MX2273, the XJ85 single-spool axial-flow turbojet is being developed by the G.E. Small Aircraft Engine Department under a U.S.A.F. contract. In the 2,000 lb. (907 kg.) thrust category, it was intended originally as a simple engine for pilotless drone aircraft, but a "long-life" version is also under development for possible use in jet trainer and executive aircraft. Its weight has been given as 300 lb. (136 kg.).

THE GENERAL ELECTRIC J79.

The J79 turbojet is the first high-compression variable-stator engine built in the United States. It has several rows of variable-incidence compressor stator blades, the setting of each row being adjusted by rams moved by engine fuel to achieve optimum air flow angles for each stage at all engine speeds. It also has constant-speed characteristics.

The J79-GE-3, as fitted in the Lockheed F-104 and tested in a modified Douglas F4D naval interceptor, has an afterburner to ensure a combination of very high thrust at high Mach numbers with comparative economy at subsonic speeds. This engine completed successfully its first 50-hour type test in August, 1955.

The J79 also powers the Convair B-58 Hustler and Grumman F11F-1F Tiger. The following data apply to the J79-GE-1.

TYPE.—Variable-stator axial-flow turbojet.
COMPRESSOR.— Seventeen-stage axial-flow. All-steel rotor and stator blading. Compression ratio 12 : 1. Air mass flow approx. 160 lb./sec. (73 kg./sec.). Variable-incidence inlet guide vanes and six variable-incidence rows of stator blades.
COMBUSTION CHAMBER.—Annular type with 12 injectors. Dual ignition.
TURBINE.—Three-stage axial-flow.
AFTERBURNER.—Short 2,000°K. type with fully-variable nozzle.
DIMENSIONS.—
Diameter of engine 32.5 in. (825 mm.).
Diameter of afterburner nozzle 36 in. (915 mm.).
Length with afterburner 204 in. (5,180 mm.).
WEIGHT.—
Dry weight 3,190 lb. (1,446 kg.).
PERFORMANCE RATING (approx.).—
Take-off (static) 11,000 lb. (4,990 kg.).
Take-off (static) with afterburner 17,000 lb. (7,710 kg.).

THE GENERAL ELECTRIC CJ-805.

The CJ-805 is a commercial version of the J79, previously described. It will power the Convair 880 transport and is already being bench-run.

The following versions have been announced.

CJ-805-1. Initial production version. Rated at 10,500 lb. (4,763 kg.) s.t. Data below refer to this type.

CJ-805-2. De-rated version, rated at approximately 9,000 lb. (4,080 kg.) s.t.

CJ-805-3. Increased r.p.m. and higher turbine inlet temperature. Rated at 11,200 lb. (5,080 kg.) s.t.

CJ-805-11. Developed version rated at approximately 12,000 lb. (5,445 kg.) s.t.

CJ-805-13. Similar to CJ-805-11, but augmented.

DIMENSIONS.—
Diameter 33 in. (838 mm.).
Length 132 in. (3,350 mm.).
WEIGHT.—
Dry weight 2,690 lb. (1,220 kg.).
PERFORMANCE RATING.—
Take-off (static) 10,500 lb. (4,763 kg.).
FUEL CONSUMPTION.—
Take-off rating 0.8 lb./lb. s.t./hr. (0.8 kg./kg. s.t./hr.).

THE GENERAL ELECTRIC T64.

The T64 is a "convertible" gas turbine engine which is under development for the U.S. Navy Bureau of Aeronautics. It will be a single-spool engine, with a compression ratio of up to 11 : 1 and variable-incidence on the initial rows of stator blades.

Its convertibility arises from the fact that the basic gas turbine power section can be equipped with a remote reduction-gear, helicopter controls and torquemeter to become a shaft engine, or it can be provided with an airscrew reduction-gear, airscrew brake and interchangeable bolt-on control unit to become a turbo-prop engine.

It is envisaged for use in helicopters, STOL aircraft and convertiplanes. Both versions of the T64 are designed to operate with their axes either vertical or horizontal, or at any intermediate angle.

The engine is said to be in the 2,600 s.h.p. class and to have a power/weight ratio of better than 3 : 1. No further details are available.

THE GENERAL ELECTRIC T58.

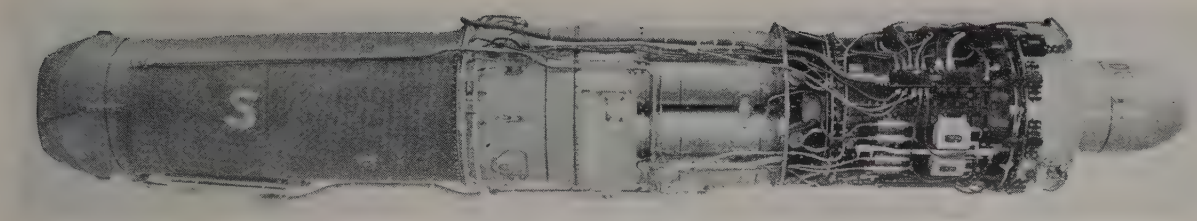
The T58 is a small free-turbine power-unit which was developed originally by the company's Small Aircraft Engine Department to meet the requirements of the Bureau of Aeronautics, U.S. Navy.

The engine is intended primarily as a power-unit for helicopters and the U.S. Navy have stated that their future helicopter plans centre around the T58. But it is also being developed for small fixed-wing training aircraft in the form of a turboprop, as an auxiliary boost unit for large piston-engined military and commercial aircraft and for marine and industrial use.

Hydro-mechanical constant speed control featured in the T58 is expected to be particularly valuable in helicopter applications. It will maintain essentially constant rotor speed by regulating the engine power automatically and eliminating the need for speed adjustment by the pilot during normal operation.



The General Electric T58 free-turbine engine.



The General Electric J47-GE-17 axial-flow turbojet engine with afterburner.

Two T58 turbines have been installed in the nose of a Sikorsky HSS (S-58) helicopter for flight testing and this aircraft flew for the first time on January 30, 1957. In addition, two Vertol H-21C helicopters are each being equipped with two T58 turbines in place of their normal single piston-engine, and will be re-designated H-21D.

First aircraft designed from the start around the T58 engine will be the new Kaman HU2K-1 utility helicopter.

TYPE.—Free-turbine shaft turbine.

COMPRESSOR.—Ten-stage axial-flow. Variable-incidence inlet guide vanes. First three rows of stator blades also have variable-incidence. Casing divided into upper and lower halves.

COMBUSTION CHAMBER.—Annular type. Sixteen fuel nozzles (eight on each of two manifolds) mounted on front of inner liner. One capacitor discharge type igniter, operated only during starting cycle.

GAS GENERATOR TURBINE.—Two-stage axial-flow type, coupled directly to compressor. Cooling by air bled from compressor.

POWER TURBINE.—Single-stage axial-flow type, mechanically independent of gas generator turbine.

ACCESSORY DRIVES. — Engine accessories driven partly by the compressor shaft. Airframe accessories mounted on free-turbine reduction gearbox or rotor hub.

DIMENSIONS. —
Diameter 16 in. (406 mm.).
Length 59 in. (1,499 mm.).

WEIGHT.—
Without reduction gear 250 lb. (113 kg.).
With reduction gear 325 lb. (148 kg.).

PERFORMANCE RATING.—
Without reduction gear 1,050 s.h.p.
With reduction gear 1,024 s.h.p.
Max. continuous rating 875 s.h.p.

CONSUMPTION.—
Fuel 0.69 lb. (0.313 kg.) per s.h.p./hr. at max. continuous rating.

THE GENERAL ELECTRIC J47 SERIES.

The J47 is a development of the J35, the development and production of which is now the responsibility of the Allison Division of General Motors. Although of approximately the same size and weight as the J35, the late production model J47 has a dry thrust rating of 6,000 lb. (2,725 kg.), as compared with 4,000 lb. (1,816 kg.) of its predecessor.

The first installation of the J47 was in the North American F-86A single-seat fighter in 1948, and more than 36,500 engines of this basic type were built before production was completed in 1956.

Unique in the later North American F-86D are the General Electric automatic electronic engine controls which regulate the fuel flow for best performance throughout all combinations of speed, altitude, engine r.p.m., temperature and other factors affecting engine performance.

The following are some of the models of the J47 installed in current U.S.A.F. aircraft :—

J47-GE-2. Installed in the North American FJ-2 Fury.

J47-GE-11. Installed in the Boeing B-47A and first 87 B-47B.

J47-GE-13. Installed in the North American F-86E and B-45C.

J47-GE-15. Installed in the North American B-45C.

J47-GE-17B. Installed in the North American F-86D, F-86K and F-86L. Basically the same as the -23 engine except fitted with afterburner and new electronic controls. Engine is completely anti-iced with hot air bled from compressor to air inlet guide vanes, fairings and support struts. Air inlet screen is retractable after take-off. Considerable reduction in use of strategic materials.

J47-GE-19. Installed in jet-pods of Convair B-36D, B-36F and B-36J. Same data as -11, -13 and -15 except that this model has high-altitude ignition and starting system.

J47-GE-23. Installed in Boeing B-47B and RB-47B. Basically same as -17 but without afterburner, and hydraulic control instead of electronic.

J47-GE-25A. Installed in Boeing B-47E and RB-47E. Rated at 5,970 lb. (2,710 kg.) dry. Fitted with water/alcohol injection. Also built by Packard Motor Company and the Studebaker Corporation to G.E. design.

J47-GE-27. Installed in North American F-86F. Has lower fuel consumption than earlier J47-GE-13 and is anti-iced.

J47-GE-33. Installed in later production F-86D.

In June, 1955 the J47 became the first U.S. turbojet to be licenced to a European manufacturer when an agreement was signed for production of the J47-27 and J47-33 by Fiat in Italy.

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular inlet surrounding accessories section, which is enclosed in domed cover. Hollow inlet guide vanes and compressor front frame struts are anti-iced by air tapped from 12th stage of compressor. Retractable air inlet screens for protection in ground running only. Inlet air flow 103 lb. (46.7 kg.) per sec.

COMPRESSOR.—Twelve-stage axial-flow. Compression ratio 5.35 : 1. Built up of twelve separate discs, first nine of 14S aluminium alloy and last three of 410 Cr. steel, splined together and secured by axial tie-bolts. Steel rotor blades secured in disc rims by dovetail-type roots. Compressor casing, with dovetail-rooted stator blades, in two halves and bolted together along horizontal centre-line. Compressor shaft carried in bearings supported by front compressor frame and engine mid-frame.

COMBUSTION CHAMBERS.—Eight cylindrical interconnected Inconel chambers with perforated ceramic-coated inner liners. Duplex fuel nozzles in front ends of liners with down-stream injection. Igniter plugs in two chambers. If water/alcohol injection is provided, mixture is injected into chambers through four circumferentially-located nozzles fed from individual manifolds surrounding each chamber, which in turn are supplied from a single manifold surrounding engine.

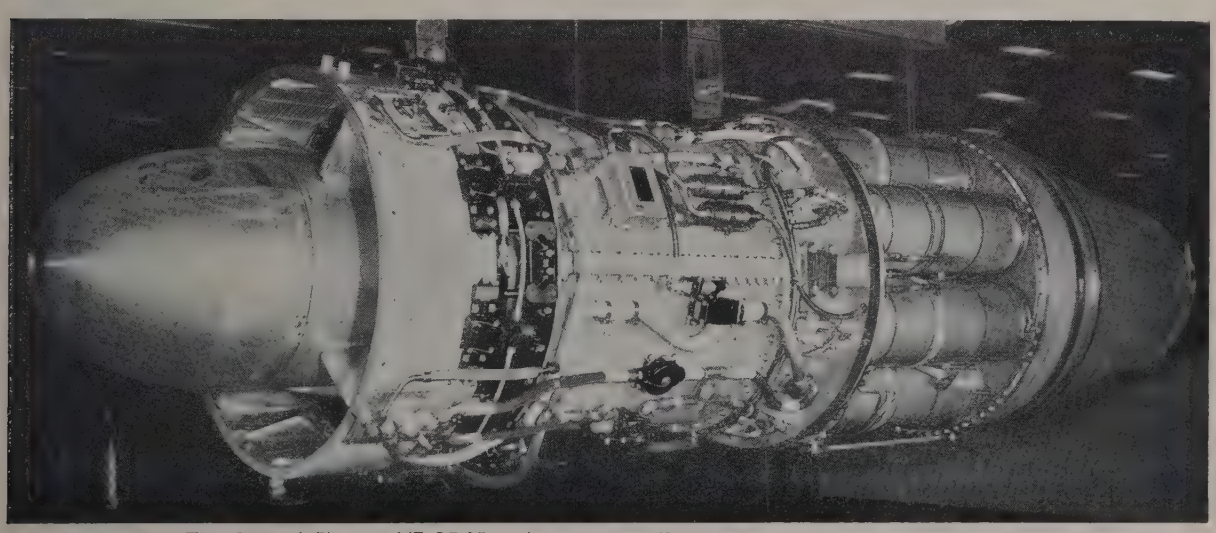
FUEL SYSTEM.—Constant-displacement gear-type fuel pump. Hydraulic fuel control system.

FUEL GRADE.—JP-1, 2, 3 or 4 Turbofuel, or Mil-F-5572 Gasoline.

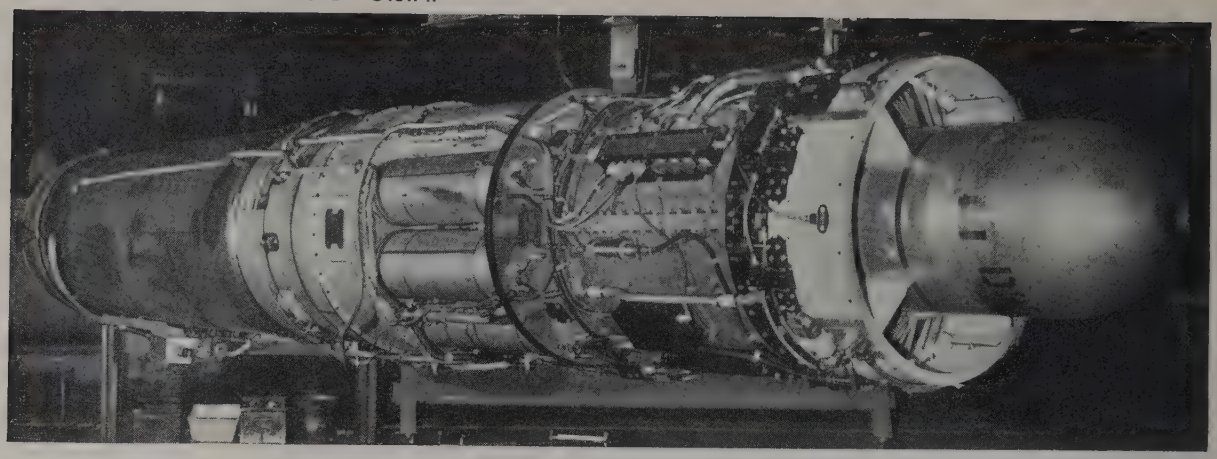
NOZZLE GUIDE VANES.—64 cast stainless blades welded to inner and outer diaphragm bands.

TURBINE.—Single-stage axial flow. Turbine disc of Timken Alloy 16-25-6 stainless steel welded to steel hub. Disc cooled fore and aft by air bled from 8th and 12th compressor stages respectively. Turbine blades of S-816 heat-resisting alloy dovetailed into periphery of disc. Hollow turbine shaft, supported in two bearings, is splined to compressor shaft and locked by through-bolt.

JET PIPE.—Fixed inner cone and sheet steel outer casing. Afterburner (in J47-GE-17) has automatic control and adjustable "eye-lid" type jet nozzle. Max. tailpipe temperature 1,275°F.



The General Electric J47-GE-25 turbojet engine (5,970 lb.=2,710 kg. s.t. at sea level).



The General Electric J47-GE-33 turbojet engine with afterburner.

GENERAL ELECTRIC J47 ENGINE DATA.

Engine Model	S/L. Static Thrust (Dry)	S/L. Static Thrust (Augmented)	Normal Thrust	Dry weight with Components	Length with Tailcone	Maximum Diameter	Normal Fuel Consumption
J47-17B	5,425 lb. (2,463 kg.) at 7,950 r.p.m.	7,500 lb. (3,402 kg.) at 7,950 r.p.m.	4,490 lb. (2,038 kg.) at 7,950 r.p.m.	3,263 lb. (1,481.4 kg.)	228 in. (5,790 mm.)	36.75 in. (933 mm.)	1.13 lb./lb. s.t./hr. (1.13 kg./kg. s.t./hr.)
J47-23	5,880 lb. (2,670 kg.) at 7,950 r.p.m.	None	5,270 lb. (2,390 kg.) at 7,630 r.p.m.	2,516 lb. (1,142.3 kg.)	145 in. (3,683 mm.)	36.75 in. (933 mm.)	1.037 lb./lb. s.t./hr. (1.037 kg./kg. s.t./hr.)
J47-25A	5,970 lb. (2,710 kg.) at 7,950 r.p.m.	7,200 lb. (3,266 kg.) at 7,950 r.p.m.	5,320 lb. (2,413 kg.) at 7,630 r.p.m.	2,554 lb. (1,159.5 kg.)	145 in. (3,683 mm.)	36.75 in. (933 mm.)	1.028 lb./lb. s.t./hr. (1.028 kg./kg. s.t./hr.)
J47-27	5,970 lb. (2,710 kg.) at 7,950 r.p.m.	None	5,320 lb. (2,413 kg.) at 7,620 r.p.m.	2,607 lb. (1,183.5 kg.)	148 in. (3,759 mm.)	36.75 in. (933 mm.)	1.028 lb./lb. s.t./hr. (1.028 kg./kg. s.t./hr.)
J47-2	6,000 lb. (2,724 kg.) at 7,950 r.p.m.	None	5,350 lb. (2,427 kg.) at 7,630 r.p.m.	2,572 lb. (1,167.7 kg.)	148 in. (3,759 mm.)	36.75 in. (933 mm.)	1.025 lb./lb. s.t./hr. (1.025 kg./kg. s.t./hr.)
J47-33	5,550 lb. (2,517 kg.) at 7,950 r.p.m.	7,650 lb. (3,470 kg.) at 7,950 r.p.m.	5,100 lb. (2,313 kg.) at 7,950 r.p.m.	3,196 lb. (1,450 kg.)	228 in. (5,790 mm.)	36.75 in. (933 mm.)	1.13 lb./lb. s.t./hr. (1.13 kg./kg. s.t./hr.)

ACCESSORY DRIVES.—In front compressor frame section and driven through reduction gearing by common drive shaft coupled directly to compressor rotor.

LUBRICATION SYSTEM.—Pressure feed to main components with return oil system to bearings and accessory gears.

MOUNTING.—Four pads on rear compressor frame, two on vertical and two on horizontal centre-line.

STARTING.—General Electric 24-volt direct-coupled starter-generator. Two igniter plugs.

DIMENSIONS, WEIGHTS AND RATINGS.—See Table.

THE GENERAL ELECTRIC J73 SERIES.

The J73 Series is dimensionally interchangeable with the J47, previously described, but incorporates a number of new features. These include the so-called "cannular" type of combustion system, consisting of a single combustion space containing ten individual "cans"; a twelve-stage axial-flow compressor and a two-stage turbine; a larger air inlet area achieved by re-locating some accessories below engine; "all-weather" features, including hot-air anti-icing and retractable air inlet screens, etc. Exhaust temperatures are controlled electrically. The oil is cooled by the engine fuel and is contained in a tank on the engine. A variable tail-pipe exhaust nozzle is fitted.

A J73-GE-3 powers the North American F-86H. Production of the J73 was completed early in 1956.

DIMENSIONS.—
Diameter 36.75 in. (933 mm.).
Length 148.2 in. (3,760 mm.).
Frontal area 8.5 sq. ft. (0.79 m.²).

WEIGHT.—
Dry 3,635 lb. (1,648 kg.).

PERFORMANCE RATING.—
Take-off (static) 9,200 lb. (4,170 kg.) at 8,000 r.p.m.

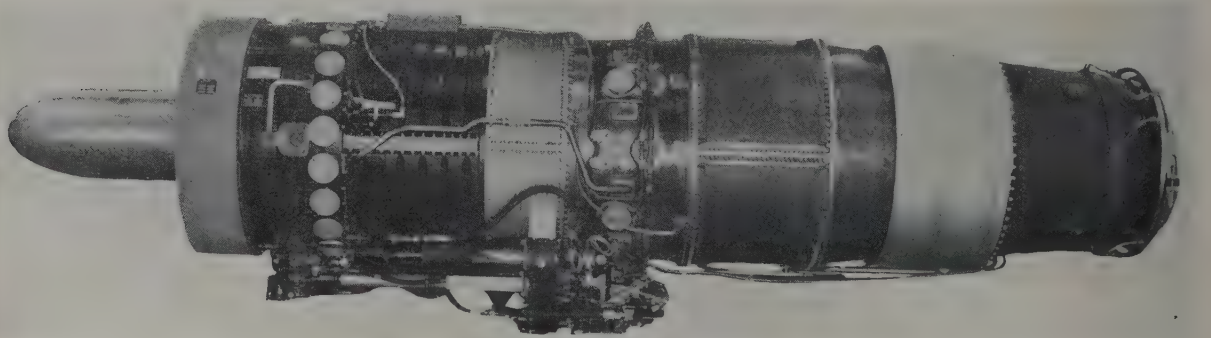
CONSUMPTIONS.—
Fuel 0.90 lb./lb. thrust/hr. (0.90 kg./kg thrust/hr.).
Oil 2 lb. (0.90 kg.) per hr. max.

THE GENERAL ELECTRIC X-405.

The X-405 is a single-chamber rocket engine, designed to power the first stage of the "Project Vanguard" earth satellite rocket. Its chamber is gimbal-mounted for directional control. Propellents are liquid oxygen and a mixture of approximately 95% gasoline, 4% alcohol and 1% silicone oil for cooling. They are fed into the chamber by turbopumps.

DIMENSIONS.—
Length approx. 70 in. (1,780 mm.).

PERFORMANCE.—
Max. thrust approx. 27,000 lb. (12,250 kg.) for 140-150 sec.
Specific impulse approx. 240.
Efflux velocity approx. 7,780 ft./sec. (2,370 m./sec.).



The General Electric J73-GE-3 turbojet engine (9,200 lb.=4,170 kg. s.t. at sea level).

HILLER

HILLER HELICOPTERS, RAMJET DIVISION.

HEAD OFFICE: 1350 WILLOW ROAD, PALO ALTO, CALIFORNIA.

President: Stanley Hiller, Jr.

Vice-Presidents: A. J. M. Chadwick and A. W. B. Vincent.

Chief Engineer: Robert Wagner.

Chief of Propulsion: Elbert Sargent.

Hiller Helicopters began the development of ramjet engines in 1949 after the company had undertaken a study to determine ways of eliminating the costly items of the conventional rotary-wing aircraft. This study showed that the complexity and costs of the present-day helicopter were largely due to the transmission, drive and torque-compensating systems and all the intricate mechanisms of the reciprocating engine. It further showed that if power could be applied to the rotor tips a far more efficient helicopter could be developed.

Hiller began with the development and evaluation of various types of pulse-jet engines but soon concentrated on the simple ramjet, and by August, 1950 had made the first flight with its initial ramjet design in the original Hornet configuration.

Further improved engines were built and tested and in March, 1953, the first successful 200-hour duration test was completed with the 8RJ2B ramjet. The first flight of the HJ-1 type helicopter fitted with two of these tip-mounted power-units was made in September, 1953.

Two further 150-hour endurance tests were made in February and September, 1954, and on October 22, 1954, Type Certificate No. 280 was awarded to the 8RJ2B ramjet engine, the first of its type to be approved by the C.A.A.

The first civil application of the 8RJ2B ramjet will be in the civil version of the Hornet helicopter. The 8RJ2B engine already powers the military YH-32 and naval HOE-1 models of the Hornet.

THE HILLER 8RJ2B RAMJET.

The 8RJ2B ramjet is a complete unit intended for helicopter rotor tip mounting. It is comprised of a diffuser, a flameholder, a combustion chamber and an exit nozzle.

The body of the engine is made up of a series of shell segments formed of thin sheet which are welded to a heavier mounting plate forming the inboard centre section of the engine. This plate which tapers in section to approximately the shell thickness at the welds, provides a thick centre boss to which the blade attachment tab is butt-welded.

The inlet is faired by an inner liner forming a diffuser, and the exit nozzle is reinforced by a thick collar welded to the shell segments. A radial rearward-sloping "finger" type flameholder is located centrally in the aft section of the diffuser. It is made up of an inner segment riveted to the mounting plate and a removable outer segment which is secured to the inner segment by the fuel hub and fairing nut. The fuel nozzle is located at the forward end of the fuel hub.

DIMENSIONS.—
Max. diameter 8.4 in. (21.3 cm.).
Overall length 21.3 in. (54.1 cm.).

WEIGHT.—
12.7 lb. (5.76 kg.).

PERFORMANCE.—
Equivalent h.p. 45.



The Hiller 8RJ2B Ramjet for helicopter rotor-tip installation.

LYCOMING

THE LYCOMING DIVISION OF THE AVCO MANUFACTURING CORPORATION.

HEAD OFFICE: 550, SOUTH MAIN STREET, STRATFORD, CONNECTICUT.

WORKS: STRATFORD, CONN., AND WILLIAMSPORT, PENNSYLVANIA.

President and General Manager: S. B. Withington.

Vice-President, Engineering: Arthur Nutt.

Vice-President, Turbine Engineering: Dr. Anselm Franz.

Vice-President, Industrial Relations: James E. Mitchell.

Vice-President, Manager, Stratford Plant: Donald F. Turner.

Vice-President, Manager, Williamsport Plant: Floyd J. Bird.

Controller: C. J. Mason.

Lycoming is developing two types of small gas-turbine engine for the U.S. Services, under the direction of Dr. Anselm Franz, who was largely responsible for design of the wartime Jumo 004 turbojet in Germany.

Designated T53 and T55, these engines are both of the free-turbine type, in which power can be held constant at varying r.p.m. and *vice versa*. Industrial, automotive and marine versions are also being developed.

THE LYCOMING LTC1.

Military designation: T53.

The T53-L-1 (Lycoming LTC1B-1) is a shaft turbine with a free turbine, which is under development under a joint U.S.A.F/U.S. Army contract Intended primarily as a helicopter engine, it is being flight-tested in a converted Kaman HOK-1 helicopter, after considerable bench-testing, and is also fitted in the Vertol 76 experimental tilt-wing aircraft. The T53 will power the production Kaman HOK-3 and Bell H-40 helicopters. A "fixed-wing" version, with an additional gearbox and drive for a 10 ft. 6 in. (3.20 m.) airscrew, will power the Grumman AO-1 observation aircraft.

TYPE.—Gas-turbine with five axial and one centrifugal stages of compression, annular combustion chamber and two mechanically-independent turbine stages.

AIR INTAKE.—Annular type casing of magnesium alloy, with 6 struts supporting reduction gearbox and accessory drive.

COMPRESSOR.—Five axial stages followed by a single centrifugal stage. Two-piece aluminium alloy stator casing with one row of fixed inlet guide vanes and five rows of stator blades, bolted to one-piece aluminium alloy diffuser casing with tangential outlet to combustion chamber. Rotor comprises five aluminium alloy discs and one aluminium alloy impeller mounted on shaft supported in ball thrust and roller bearings. Compression ratio 6 : 1. Air mass flow 10.5 lb./sec. (4.8 kg./sec.) at 19,300 r.p.m.

COMBUSTION CHAMBER.—Annular type, with one-piece sheet steel outer shell. Eleven vapourizing type fuel burners with upstream injection.

FUEL SYSTEM.—Single fuel manifold. Gear-type dual fuel pump with overspeed governor, flow control, altitude control and throttle valve.

FUEL GRADE.—Mil-G-3056A or F-5624B.

TURBINE.—Two mechanically - independent axial-flow turbine stages. Casing fabricated from sheet steel. First stage, driving compressor, uses hollow air-cooled stator vanes and cored-out cast rotor blades. Second stage, driving reduction gearing, has solid blades.

EXHAUST UNIT.—Fixed-area nozzle. Steel outer casing and inner cone.

AIRSCREW DRIVE.—No. 51A airscrew shaft. Reduction gear for airscrew maximum shaft speed of 1,700 r.p.m.

ACCESSORIES. — Electric starter. Bendix Scintilla TGLN dual ignition unit. Two igniter plugs.

LUBRICATION.—Recirculating type, with gear-type pump with one pressure and two scavenge units. Filter.

OIL GRADE.—Mil-L-7808B.

CONTROLS.— Hydro-mechanical type, with automatic acceleration and deceleration limiters. Separate fuel and airscrew control.

DIMENSIONS.—
Length overall 58.9 in. (149.6 cm.).
Diameter 23 in. (58.4 cm.).
Frontal area 2.9 sq. ft. (0.27 m.²).

WEIGHT.—
460 lb. (209 kg.).

POWER RATINGS.—
Max. take-off power 960 s.h.p. + 113 lb. (51.3 kg.) s.t. (= 1,005 e.s.h.p.) at 22,400 r.p.m.
Max. cont. power 825 s.h.p. + 101 lb. (45.8 kg.) s.t. (= 865 e.s.h.p.) at 21,800 r.p.m.

CONSUMPTIONS.—
Fuel at take-off power 0.655 lb./e.s.h.p./hr. (0.297 kg./e.s.h.p./hr.).
Oil at normal power 0.14 U.S. gallons/hr. (0.55 litres/hr.).

THE LYCOMING LTC4.

Military designation: T55.

This engine is virtually a scaled-up T53 with higher mass flow and working temperatures. Under development to a joint U.S.A.F./U.S. Army contract, it is rated initially at 1,550-1,650 s.h.p. and is intended eventually to be in the 1,800-2,000 s.h.p. range.

Two versions have been announced, as follows.

LTC4A-1. "Fixed-wing" version, specified for Fairchild Turboboxcar transport and other projects. Data below refer to this type.

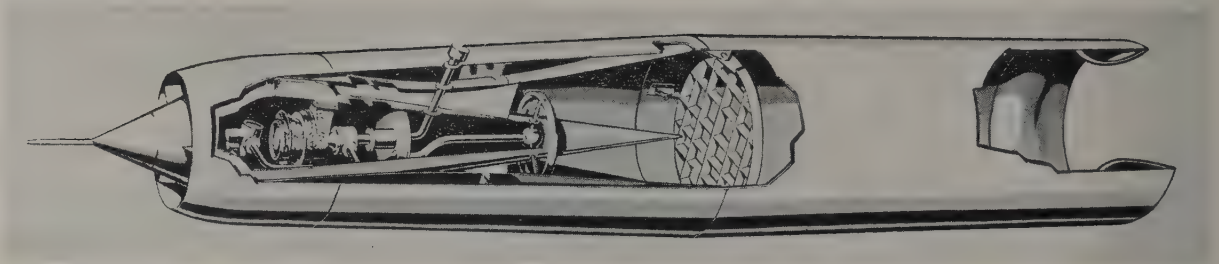
LTC4B-1. Helicopter version. Rated at 1,600 s.h.p. Dry weight 600 lb. (272 kg.).

DIMENSIONS.—
Diameter 24.25 in. (61.6 cm.).
Length 58.85 in. (149.5 cm.).

WEIGHT.—
Dry weight, equipped 695 lb. (315 kg.).

PERFORMANCE RATING.—
Max. take-off power 1,500 s.h.p. plus 378 lb. (171 kg.) jet thrust (= 1,651 e.h.p.) at 1,290 airscrew r.p.m.

FUEL CONSUMPTION.—
Max. take-off power 0.657 lb./h.p./hr. (0.298 kg./h.p./hr.).



A sectional drawing of the Marquardt MA-20C 28-inch supersonic ramjet.

MARQUARDT AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: 16555 SATICOY STREET, VAN NUYS, CALIFORNIA.

President: Roy E. Marquardt.

Executive Vice-President: Robert L. Earle.

Vice-President (Legal and Finance): William H. Schwebel.

Vice-President (Engineering): Don. L. Walter.

Chief Engineer (Power-plants): John S. Winter.

Chief Engineer (Test Facilities): Leigh E. Dunn.

Chief Engineer (Accessories): A. J. Kreiner.

Director (Long-range Planning and Research): John A. Drake.

The Marquardt Aircraft Company was formed in November, 1944 to undertake the research and development of subsonic ramjet engines, and at that time it was the only company to be engaged exclusively in this work in the United States.

Testing techniques and facilities were without precedent; manufacturing methods were undeveloped; empirical data on ramjet engine performance and the required knowledge of the high-temperature behaviour of materials were then non-existent. These and many other problems had to be met before early tests proved successful and Government contracts were forthcoming.

The first of these contracts was for the development of a 20-inch diameter subsonic ramjet developing the equivalent of 2,500 horsepower. Then followed similar contracts for larger engines of 30 and 48 inch diameters and of proportionally higher thrusts in the subsonic range, as well as for supersonic ramjet engines in varying sizes and types. More than fifty of the 20-inch engines were tested on various piloted aircraft and guided missiles of the U.S. armed forces. The first piloted flight was made with a Lockheed F-80 Shooting Star fitted with a Marquardt 30-inch ramjet at each wing-tip. During flight the normal power-plant of the F-80 was switched off to achieve pure ramjet flight.

The first production order for ramjet engines was awarded for Marquardt 20-inch engines for installation in the U.S. Navy KDM-1 drones manufactured by the Martin Company.

Much of the work done by Marquardt in the field of supersonic ramjets remains under military security, but it can be said that the engines have established records for speed, distance and endurance for air-breathing engines well up in the supersonic range. Most of these records were established under actual flight conditions on missile test-beds. In all cases the supersonic ramjet performed as predicted and in some instances exceeded performance expectations.

The company also develops and manufactures fuel control equipment and air and hydrogen peroxide turbine-driven accessory power-plants to meet the hydraulic, electrical and fuel-pump requirements of ramjet and rocket-powered missiles and turbojet-powered aircraft.

The Marquardt Jet Laboratory is one of the most powerful facilities in the United States for the testing of ramjet engines and related equipment and accessories. It is capable of testing full-scale flight ramjet engines and can simulate speeds approaching 2,000 m.p.h. (3,200 km.h.) and altitudes above 80,000 ft. (24,400 m.).

Marquardt is also developing and manufacturing variable-area turbojet exhaust nozzles of advanced design for nearly all of the major engine companies in the United States and Canada.

One completely new type of multi-purpose variable-area exhaust nozzle incorporates a reverse-thrust feature. Another feature of the nozzle is its ability to trim in flight to an area which will achieve the minimum specific fuel consumption for the turbojet engine for a given cruise thrust requirement. This feature alone will more than pay for the added weight of the nozzle (less than 100 pounds) in fuel saved and increased range and endurance.

Marquardt has attained major stature as the developer and producer of ram air emergency power-units which supply electrical and hydraulic power to turbojet piloted aircraft if the main power-plant fails. These units are now in operation on the Chance Vought F8U-1, the Convair F-102 and the Lockheed F-104.

In 1956 Marquardt contracted with the U.S. Air Force to develop through to preliminary flight rating a 36 in. ramjet which carries the company designation MA-24, and which has higher performance capabilities than those being developed by Marquardt for the Bomarc weapons system programme.

As a result of the success of its supersonic ramjet development programme, Marquardt is building a manufacturing plant and production acceptance testing facility at Ogden, Utah. The first part of this installation was due to be occupied in the first quarter of 1957.

In the Summer of 1955, Marquardt became a partner in the OMAR group for co-operative research into the chemistry, thermodynamics and engineering of supersonic propulsion, the other partners being Reaction Motors and Olin Mathieson Chemical Corporation, which is the parent company of Reaction Motors.



The Marquardt two-dimensional ramjet for helicopter rotor-tip installation.

THE MARQUARDT MA-19G.

U.S. Navy designation: RJ30-MA-6.

TYPE.—Subsonic Ramjet.
MAXIMUM EXHAUST TEMPERATURE.—Over 3,000°F.
DIMENSIONS.—
Max. length 87.25 in. (221.6 cm.).
Diameter 20.0 in. (50.8 cm.).
WEIGHT DRY.—
126 lb. (57.2 kg.).
PERFORMANCE RATINGS.—
Max. net thrust 1,450 lb. (660 kg.).
Rated net thrust 1,200 lb. (545 kg.).

THE MARQUARDT TWO-DIMENSIONAL RAMJET.

TYPE.—Subsonic Ramjet.
DIMENSIONS.—
Length 16.5 in. (42 cm.).
Span 20 in. (50.8 cm.).
Thickness 2.5 in. (6.3 cm.).
WEIGHT DRY.—4 lb. (1.8 kg.).
PERFORMANCE.—
Rated net thrust 40 lb. (18.16 kg.).

THE MARQUARDT MA-20C.

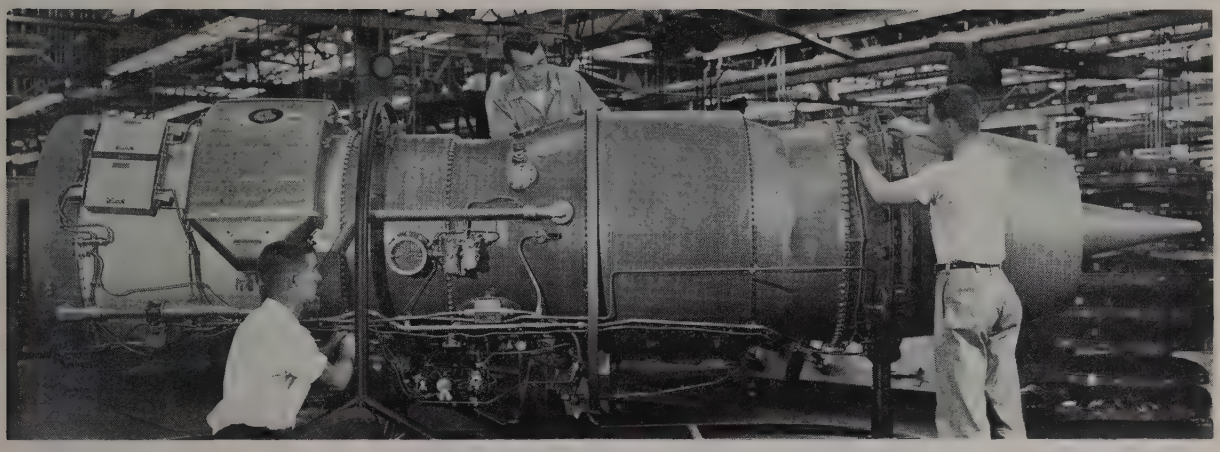
Military designation: RJ43.

Few details of this comparatively large ramjet engine are available for publication, beyond those which can be gained from the accompanying cutaway drawing. It is intended for use at supersonic speeds.

The RJ43 (company designation MA-20C) has a fixed-geometry air intake, a centre-body which houses the fuel system and controls, and a convergent/divergent nozzle. The kerosene fuel is fed by a ram-air turbine pump.

Extensively tested under the Lockheed X-7 test vehicle, the RJ43 powers the Boeing Bomarc interceptor missile.

DIMENSIONS.
Diameter 28 in. (710 mm.).
Length approx. 145 in. (3,685 mm.).
WEIGHT DRY.—
485 lb. (220 kg.).
PERFORMANCE RATING.—
Max. thrust at S/L approx. 11,500 lb. (5,220 kg.).



The Pratt & Whitney J75 turbojet engine (17,200 lb.=7,800 kg. s.t.).

THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST HARTFORD 8, CONNECTICUT.

Vice-President: Wright A. Parkins.

General Manager (Connecticut): L. C. Mallet.

General Manager (CANEL): B. A. Schmickrath.

General Manager (Florida): C. T. Roelke.

Engineering Manager: A. E. Smith.

Assistant Engineering Manager: Perry W. Pratt.

Sales Manager: T. E. Tillinghast.

Factory Manager: John L. Bunce.

Pratt & Whitney Aircraft entered the gas-turbine engine field in 1947 by acquiring the American manufacturing and sales rights for the Rolls-Royce Nene engine. These rights were later expanded to include the Rolls-Royce Tay, a development of the Nene. Both these engines were developed to meet U.S. Navy requirements and to incorporate materials, parts and accessories from United States sources. As the J42 and J48, respectively, they have been produced in quantity to power mainly the Grumman F9F-2 and F9F-5 Panther, the Grumman F9F-6 and F9F-8 Cougar and the Lockheed F-94C Starfire. The J48 is still in production.

Pratt & Whitney Aircraft has been in production with the J57 dual-compressor axial-flow turbojet, the first American engine to be rated in the 10,000-lb. thrust class, since February, 1953. The T34 turboprop engine is also in production.

The existence of the J75 axial-flow turbojet and the T57 turboprop adaptation of the J57 was revealed in 1954, but for security reasons little information about these engines has been released for publication. Although still classified, the J75 in a civil form (JT) is specified for installation in versions of the Boeing 707 and Douglas DC-8 civil jet airliners, as is the JT3, a civil version of the J57.

Both the JT3 and JT4 were certified by the C.A.A. for airline use on March 15, 1957, being the first American-built turbojets to receive such certification.

A new medium-size turbojet, designated J52, was announced in December, 1956, but few details have been released.

In January, 1957, Pratt & Whitney occupied more than seven million square feet of floor area in twelve Connecticut towns, and employed 40,000 people. More than 80% of its current production consists of gas-turbine engines.

The company's nuclear engine programme is carried on as a separate operation at a U.S.A.F.-sponsored facility in Middletown, Connecticut. Begun in 1951, this project is now covered by the code-name of CANEL (Connecticut Aeronautic Nuclear Engine Laboratory).

Third Pratt & Whitney operational unit will consist of a development and test centre that is being built at West Palm Beach, Florida.

THE PRATT & WHITNEY J75.

First announced in 1954, few details of this twin-compressor axial-flow turbojet engine have been released. It is more powerful than the J57 and powers the Convair F-106 interceptor, the production Martin P6M-2 SeaMaster flying boat and the Republic F-105 Thunderchief fighter. Production of the J75 began in the Spring of 1957, after more than two years of flight testing in research and experimental aircraft.

The commercial version of the J75, known as the JT4, received C.A.A. certification for airline use in March, 1957 and will power versions of the Boeing 707 and Douglas DC-8 jet airliners.

DIMENSIONS.—
Diameter 58.5 in. (1,485 mm.).
Length overall 214 in. (5,435 mm.).
WEIGHT DRY.—
5,300 lb. (2,404 kg.).
PERFORMANCE (J75).—
Max. T.O. thrust 17,200 lb. (7,800 kg.).
Max. T.O. thrust with afterburner approx. 24,500 lb. (11,115 kg.).
PERFORMANCE (JT4A).—
Max. T.O. thrust 15,500-16,800 lb. (7,030-7,620 kg.).

THE PRATT & WHITNEY J57.

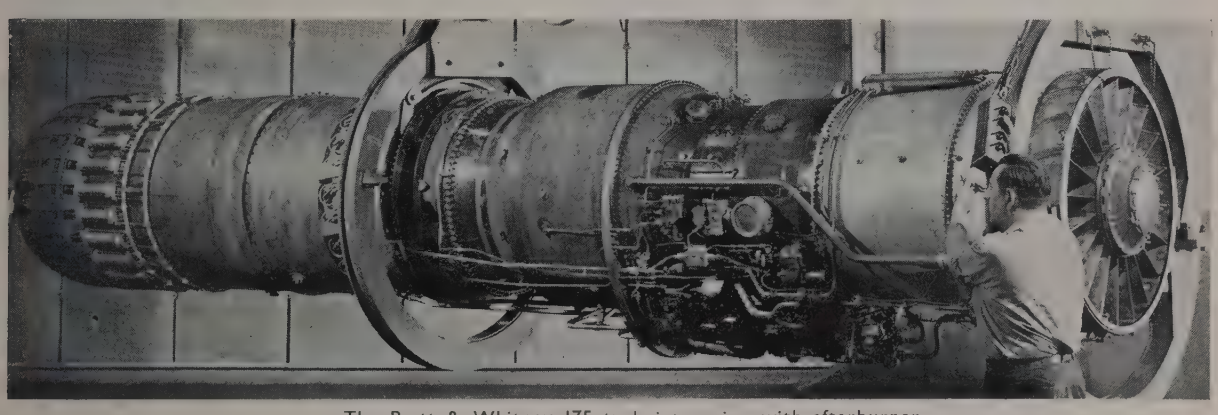
The J57 is a large axial-flow turbojet engine which is in production for the U.S.A.F. and powers the majority of America's current first-line fighter and bomber aircraft.

The particular feature of the J57 is the two-spool compressor which consists of seven-stage high-pressure and nine-stage low-pressure compressors mounted in tandem on concentric shafts. The low-pressure compressor and a two-stage low-pressure turbine are on the inner shaft, while the high-pressure compressor and a single-stage high pressure turbine are on the outer shaft.

Between the compressor and turbine is the combustion chamber which, in the J57, is of the "cannular" type, comprising an outer annular casing which encloses eight "cans" or flame-tubes. Air mass flow is 181 lb./sec. (82 kg./sec.) and compression ratio 12.5 : 1.

Basic design of the J57 began in 1947 and the final design was adopted in 1949 after extensive component testing. The prototype ran for the first time in January, 1950 and a J57 became airborne for the first time in March, 1951 in a B-50 flying test bed, soon after passing its 50-hour preliminary flight rating test.

The J57 began its 150-hour qualification tests on September 8, 1952, and the engine went into production in February, 1953. By March, 1957 more than 8,000 J57's had been delivered.



The Pratt & Whitney J75 turbojet engine with afterburner.



The Pratt & Whitney J75 (*left*) and J57 turbojet engines, both fitted with afterburners.

Several models of the J57, both with and without afterburners, are now in production.

The J57 powers the Boeing B-52 eight-jet bomber, the Boeing KC-135 four-jet tanker-transport, the North American F-100, Convair F-102 and McDonnell F-101 fighters, the Douglas F4D-1 and Chance Vought F8U-1 naval fighters and the Douglas A3D naval attack bomber.

The J57 in its civil form (JT3) has been selected to power versions of the Boeing 707 and Douglas DC-8 jet airliners and was certified by the C.A.A. for airline use in March, 1957.

The following data refer specifically to the J57-P-19 and -31 versions.

DIMENSIONS.—
Diameter 40 in. (1,015 mm.).
Length 180 in. (4,572 mm.).

DRY WEIGHT.—
4,100 lb. (1,860 kg.).

PERFORMANCE RATING.—
Max. T.O. power 13,000 lb. (5,900 kg.) s.t. with water injection at 8,000 low-pressure r.p.m.

FUEL CONSUMPTION.—
Max. T.O. power 0.82 lb./lb. s.t./hr. (0.82 kg./kg. s.t./hr.).

THE PRATT & WHITNEY T57.

Although it was first revealed in 1954, few details of this very large turboprop engine have been released officially, except that it is based on the J57 turbojet and is fitted with a Hamilton Standard Turbo-Hydromatic airscrew of 20 ft. (6.10 m.) diameter.

For initial flight testing, a T57 has been mounted in the nose of a Douglas C-124 Globemaster flying test-bed aircraft. It was scheduled to power the 500,000 lb. (226,800 kg.) Douglas C-132 military transport, and has no known applications now that development of this aircraft has been abandoned.

THE PRATT & WHITNEY J52.

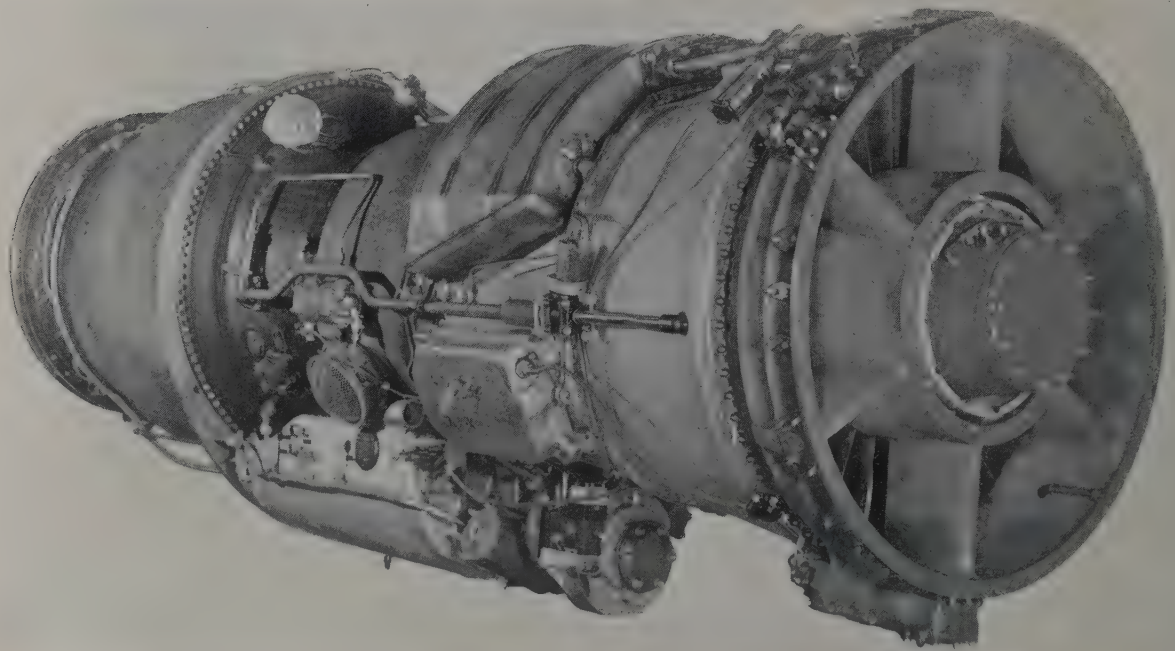
Announced in December, 1956, the J52 turbojet is a medium-sized engine which was designed under the auspices of the U.S. Navy Bureau of Aeronautics to meet the power plant requirements of a variety of new naval aircraft, including a supersonic trainer and a small high-speed fighter.

Few details of the J52 are available for publication. It is reported to be a two-spool turbojet, with a "cannular" type combustion system fed by 12 injectors, mechanically-independent high-pressure and low-pressure turbines and provision for an afterburner with multiple injectors and a variable-area nozzle. The J52-P-2 version is rated at 7,500 lb. (3,400 kg.) s.t. dry, with a specific fuel consumption of 0.8 lb./lb. s.t./hr. (0.8 kg./kg. s.t./hr.).

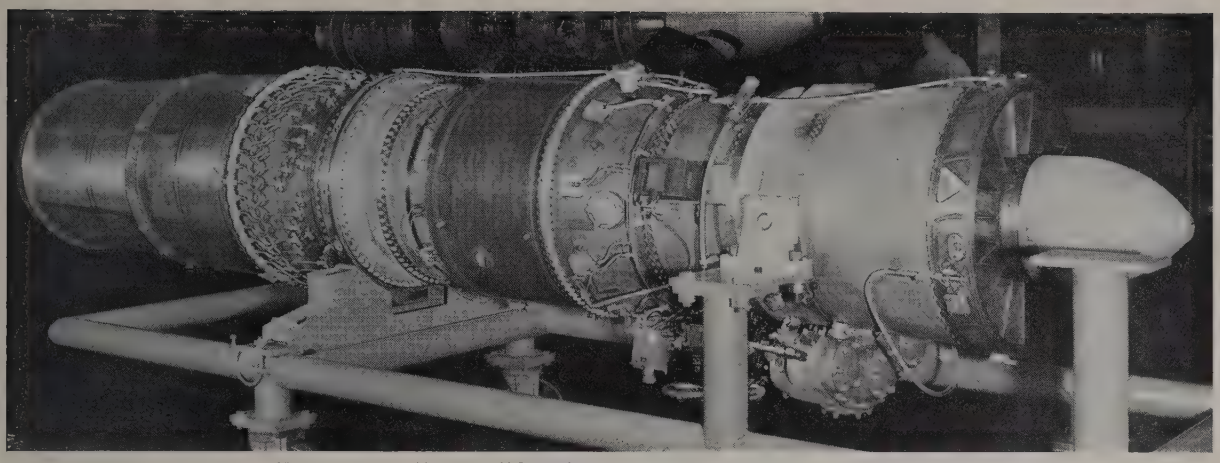
THE PRATT & WHITNEY J48

The J48 is the result of pooling of the engineering talents of two of the World's leading engine builders—Pratt & Whitney Aircraft and Rolls-Royce, Ltd. The basic design is Rolls-Royce, the British version of the J48 being known as the Tay.

The J48 is a development of the J42 which is the Pratt & Whitney-built Nene. A re-designed impeller and larger turbine blades enable the J48 to consume 30 per cent. more air and, in turn, to



The Pratt & Whitney J57 axial-flow turbojet engine which powers many current U.S. fighters and bombers.



The Pratt & Whitney J52 turbojet engine (7,500 lb.=3,400 kg. s.t.).

produce more thrust. The J48 is, however, essentially interchangeable with the J42 because dimensional differences are slight. One of Pratt & Whitney's main independent contributions to the J48 is the afterburner.

DIMENSIONS.—
Diameter 50.5 in. (1,283 mm.).
Length (without fixed nozzle) 109.75 in. (2,788 mm.).

WEIGHT DRY.—
2,080 lb. (944 kg.).

PERFORMANCE RATINGS.—
Take-off (and Military) rating 7,250 lb. (3,290 kg.) s.t.
Normal rating 5,600 lb. (2,540 kg.) s.t.
Cruise rating 3,750 lb. (1,700 kg.) s.t.

FUEL CONSUMPTIONS.—
At take-off output 1.14 lb./lb. s.t./hr. (1.14 kg./kg. s.t./hr.).
At normal output 1.12 lb./lb. s.t./hr. (1.12 kg./kg. s.t./hr.).
At cruise output 1.14 lb./lb. s.t./hr. (1.14 kg./kg. s.t./hr.).

THE PRATT & WHITNEY T34

The T34 is a single-unit high-pressure axial-flow turboprop engine, the active development of which was begun in June, 1945 under the auspices of the U.S. Navy Bureau of Aeronautics as part of the Navy's overall programme to develop this type of power-plant. A T34 engine completed a 50-hour flight rating test at 5,700 h.p. and flight testing in the nose of a Boeing B-17 began in August, 1950.

The T34 has a 13-stage axial-flow compressor with an annular type burner and a three-stage axial-flow turbine. Stainless steel is used almost exclusively in the construction of the T34.

The airscrew reduction gear is flexibly coupled to the front of the compressor shaft and the compressor and turbine are rigidly coupled at the rear of the compressor case. The reduction gear uses two stages and operates at an 11 : 1 ratio.

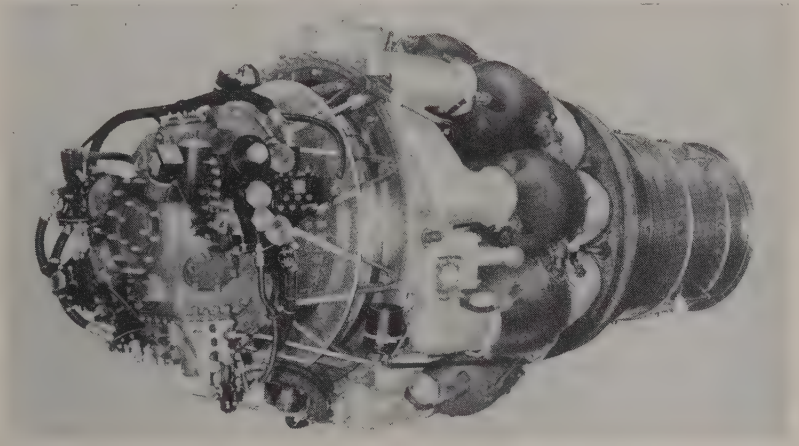
The engine incorporates a mechanical control system in which a single lever is linked to mechanical controls that automatically control the fuel flow and coordinate it with airscrew speed, flight speed and altitude for the particular power selected by the pilot.

(567.5 kg.) jet thrust (6,000 equivalent s.h.p.).

Military rated output 5,300 s.h.p. plus 1,250 lb. (567.5 kg.) jet thrust (5,800 equivalent s.h.p.).

Normal rated output 4,750 s.h.p. plus 1,125 lb. (511 kg.) jet thrust (5,200 equivalent s.h.p.).

Cruising output (80% normal rating) 3,800



The Pratt & Whitney J48 turbojet engine.

De-icing is accomplished by hot air bled from the engine to the air inlet area.

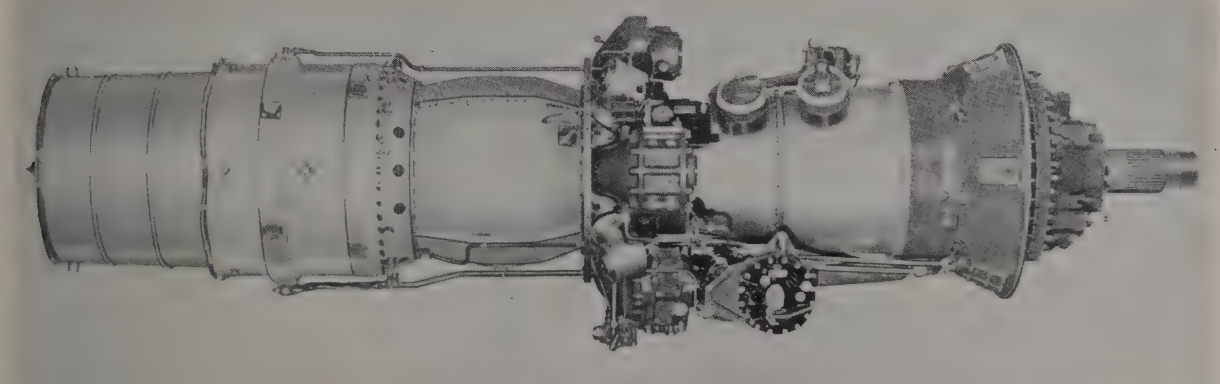
The T34-P-3 version powers the four-engined Douglas C-133A military transport aircraft, which is in production for the U.S.A.F.

DIMENSIONS.—
Max. diameter 33.75 in. (857 mm.).
Max. length 156.8 in. (3,983 mm.).

WEIGHT DRY.—
2,670 lb. (1,210 kg.).

PERFORMANCE RATINGS.—
Take-off output 5,500 s.h.p. plus 1,250 lb. s.h.p. plus 1,000 lb. (454 kg.) jet thrust (4,200 equivalent s.h.p.).
Cruising output (60% normal rating) 2,850 s.h.p. plus 875 lb. (427 kg.) jet thrust (3,200 equivalent s.h.p.).

FUEL CONSUMPTIONS.—
At take-off power 0.630 lb. (0.286 kg.) per equiv. s.h.p./hr.
At military power 0.635 lb. (0.288 kg.) per equiv. s.h.p./hr.
At normal power 0.655 lb. (0.297 kg.) per equiv. s.h.p./hr.
At cruise (80% power) 0.70 lb. (0.318 kg). per equiv. s.h.p./hr.



The Pratt & Whitney T34 turboprop engine (5,500 s.h.p. plus 1,250 lb.=567.5 kg. jet thrust).

RMI

REACTION MOTORS, INC.

HEAD OFFICE, WORKS AND LABORATORY: DENVILLE, NEW JERSEY.

FIELD OFFICES: LOS ANGELES, CALIFORNIA; DAYTON, OHIO; AND WASHINGTON, D.C.

President: Raymond W. Young.

Executive Vice-President: Henry H. Michaels, Jr.

Vice-President of Operations: Robert S. Kinsey.

Secretary and General Counsel: Alexander L. Keyes.

Treasurer: James W. Fay, Jr.

Manager of Engineering and Research: William P. Munger.

Manager of Customer Relations and Contracts: Warren P. Turner.

Manager of Industrial and Public Relations: David G. Keller.

Reaction Motors, Inc. designed and built the first rocket-type power-unit for aircraft use to be developed in the United States. This engine, which carried the designation 6000C4, was used in the Bell X-1, which was the first aircraft to exceed the speed of sound.

Subsequent advanced models of the 6000 Series engine powered the Douglas D-558-2 Skyrocket; the Republic XF-91; and the Bell X-1A which has flown at a speed of over 1,650 m.p.h. (2,640 km.h.) and has reached an altitude of over 90,000 ft. (27,450 m.). RMI rocket engines have also powered many research rockets and guided missiles.

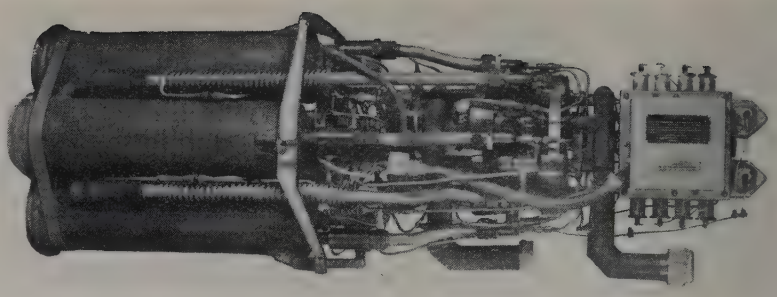
Re-design and improvement of the 6000 Series engine was completed during 1955, resulting in a new engine designation, with higher thrust and performance ratings.

The ROR (Rocket-on-Rotor) system, announced in 1954, has been tested by a U.S. Marine Corps helicopter squadron and the operational flight evaluation programme has been completed successfully. Reaction Motors have also developed small 16 lb. (7.25 kg.) s.t. peroxide rotor-tip rockets to power the Kellett KH-15 and Rotorcraft RH-1 single-seat helicopters.

Several engineering programmes devoted to the design of advanced rocket engine systems and components and to the improvement of rocket engine ignition and combustion characteristics are in hand, while various ways of improving the characteristics of present liquid rocket propellents are under investigation and new propellents are being studied and evaluated. The major work currently in hand is of a classified nature, but is known to include a contract to develop the rocket-engine for the North American X-15 manned hypersonic research aircraft.

It has been announced that Reaction Motors have fired a rocket motor of 120,000 lb. (54,430 kg.) s.t. and have made nearly 100 test runs of 50,000 lb. (22,680 kg.) s.t. motors.

In the Summer of 1955, Reaction Motors became a partner in the OMAR group for co-operative research into the chemistry, thermodynamics and engineering of supersonic propulsion, the other partners being the Marquardt Aircraft Company and Olin Mathieson Chemical Corporation, which is the parent company of Reaction Motors.



The RMI Model 6000C4 liquid rocket motor.

THE RMI 6000 SERIES ROCKET MOTOR.

Military designation: LR8-RM-6.

TYPE.—Liquid bi-propellent Rocket.

CONSTRUCTION.—Chrome-molybdenum steel girder frame supports the combustion chambers, fuel supply and control system, and includes centrally-disposed transverse frame for attachment to airframe. Stainless steel tubular combustion chambers have closed front ends and venturi-type expansion nozzles.

PROPELLENTS.—Ethyl alcohol-water mix (fuel) and liquid oxygen (oxidiser) are injected into front end of combustion chambers under pressure supplied by helium gas or pressurised nitrogen and ignited. Four control valves each in fuel and oxidiser lines to ensure uniform pressure at entry to chambers.

IGNITION.—Separate igniter in each chamber. Igniter uses fuel/oxydiser mixture which is fired by B.G. igniter plus an Eclipse coil. Electrically operated from control box on front of engine. Chambers can be fired individually, in any combination or all together.

COOLING.—Regenerative. Fuel before injection is circulated through coolant passages in exhaust nozzles and around combustion chambers.

MOUNTING.—Four circumferentially-located mounting points on main frame.

DIMENSIONS.—
Diameter 19.0 in. (482.6 mm.).
Length 56.0 in. (1,422.4 mm.).
Frontal area 2.0 sq. ft. (0.186 m.²).

WEIGHTS.—
Weight dry 210 lb. (95.34 kg.).
Weight/thrust ratio 0.035 lb./lb. thrust (0.035 kg./kg. thrust).

PERFORMANCE.—
Max. rating 6,000 lb. (2,725 kg.) thrust at any altitude.
Jet velocity 6,182 ft. (1,885.5 m.) per sec.
Specific impulse 192/sec.
Propellent consumption 0.0052 lb./lb. thrust/sec.

THE RMI 20000 C1 TURBO-ROCKET MOTOR.

Military designation: XLR10-RM-2.

This motor was built in limited quantities for the Viking high altitude research rocket.

TYPE.—Liquid bi-propellent Turbo-Rocket.

CONSTRUCTION.—Single large thrust chamber, turbopump unit, valves and controls. Stainless steel thrust chamber with rolled sheet nickel inner jacket has venturi-type expansion nozzle.

PROPELLENTS.—Ethyl alcohol (fuel) and liquid oxygen (oxidiser) are injected in front end of combustion chamber under pressure supplied by turbopump, and ignited. Valves in fuel and oxidiser lines control supply of fuel to chamber.

COOLING.—Regenerative. Before ignition, fuel is circulated through coolant passages in exhaust nozzle and around combustion chamber.

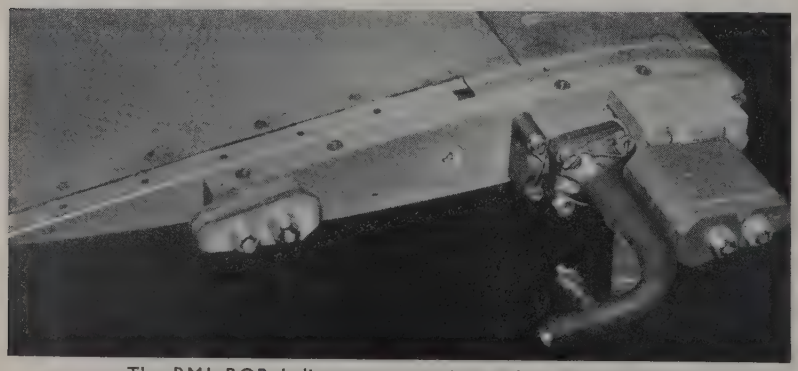
MOUNTING.—Two mounting points on chamber.

DIMENSIONS.—
Diameter 18.19 in. (461.9 mm.).
Length 33.75 in. (857 mm.).
Frontal area 1.8 sq. ft. (0.167 m.²).

WEIGHTS.—
Weight dry 225 lb. (102 kg.).
Weight/thrust ratio .011 lb./lb. thrust (.011 kg./kg. thrust).

PERFORMANCE.—
Rating 20,000 lb. (9,072 kg.) s.t. at any altitude.
Characteristic jet velocity 6,762 ft./sec. (2,061 m./sec.).
Specific impulse 210/sec.

CONSUMPTION.—
Fuel at max. rating .0047 lb./lb. thrust/sec. (0.0047 kg./kg. thrust/sec.).



The RMI ROR helicopter rotor-tip auxiliary rocket motor.

THE RMI ROR SYSTEM.

The ROR (Rocket on Rotor) system is, in fact, an auxiliary power system for helicopters to provide extra power for a relatively short duration of time during vertical take-off before transition to forward flight.

The system involves the use of small rocket engines in the tip of each rotor blade. Such a system has been flight-tested in a U.S. Marine Corps HRS-2 helicopter and has shown the following results:—(*a*) provided approximately 20 per cent. boost in power at sea level; (*b*) made possible take-off with up to 100 per cent. more payload from sea level to 5,000 ft. (1,525 m.); (*c*) increased hovering ceiling under all load or altitude conditions; and (*d*) extended the gliding range by a factor of 3 to 4 with the primary power-plant inoperative.

A typical system, as used in the HRS-2 helicopter, consists of three blade-tip-mounted Model XLR-32-RM-2 rocket engines producing a total of approximately 120 h.p., a hub-mounted propellent tank, and a set of simple valves, lines and controls. The whole ROR system weighs 67 lb. (30.4 kg.) dry.

The rocket engine, which is enclosed within a rotor-tip fairing, operates by the rapid catalytic decomposition of 90 per cent. hydrogen peroxide, a mono-propellent. Each individual engine weighs about 1 lb. (0.45 kg.) and provides 40 lb. (18.1 kg.) of thrust, or about 40 h.p. at rotor r.p.m. Feed for the engine is accomplished by the pumping action of the rotor.

A hub-mounted propellent tank, shaped as a modified aerodynamically clean hemisphere, carries up to 300 lb. (136.2 kg.) of fuel, enough for 6 minutes of operation at full power.

There are two simple control elements; a master arming switch and a simple on-off firing switch which actuates all three rocket engines at once. Engines are pre-calibrated to provide, automatically, balanced thrust at each blade tip.

SOLAR

SOLAR AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: 2200, PACIFIC HIGHWAY, SAN DIEGO 12, CALIFORNIA.

MIDWEST WORKS: DES MOINES 5, IOWA.

President: Herbert Kunzel.

The Solar Aircraft Company specialises in the design, development and manufacture of heat-resistant alloy products, which broad term includes such items as small auxiliary gas-turbine power-units, afterburners, control systems of turbojet and ramjet engines, etc. It has evolved several patented processes for the manufacture of high temperature-resistant materials, for the protection of alloy steels against oxidation and corrosion, and for the aluminium coatingof high-temperature parts.

Solar also handles considerable subcontract work in the aircraft, engine and missile fields.

Solar's Mars and Jupiter gas turbines are being produced in quantity. The Mars, rated at 50-60 s.h.p., provides auxiliary power for accessories in the Douglas C-124C, Lockheed C-121C and Convair C-131B, while the Jupiter, rated at 500 s.h.p., is used as a compressor in multi-purpose turbojet support vehicles, and as a variable-speed power-unit for marine propulsion.

Solar has now designed and will produce, under a joint Navy Bureau of Aeronautics and U.S. Army contract, the smallest gas-turbine engine for aircraft propulsion. This engine, known as the YT62 Mercury, will be used to power a one-man helicopter. A variable-speed version, designated YT66, is also being developed.

THE SOLAR MERCURY.

Military designation: YT62.

The Mercury is a small shaft-turbine with a centrifugal compressor, an annular combustion chamber and a single-stage turbine. Starting will be by geared hand-crank and the engine will operate on standard military fuels. As the engine is still under security classification no further details are available for publication.

The general arrangement of the Mercury can be gathered from the accompanying illustration, which shows a wooden mock-up of the engine.

DIMENSIONS.—
Max. overall diameter 15½ in. (394 mm.).
Overall height (as shown) 20 in. (508 mm.).

WEIGHT DRY.—
50 lb. (22.7 kg.).

RATING.—
Max. 55 s.h.p. plus 12 lb. (5.45 kg.) residual thrust at 57,600 r.p.m.

THE SOLAR YT66.

The YT66 will be a variable-speed gas-turbine, developed from the constant-speed YT62 Mercury.' It will power "flying platform" aircraft under evaluation by the U.S. Army.

Dimensions, weight and performance are as for the YT62.



The Solar YT62 Mercury.

WESTINGHOUSE

WESTINGHOUSE ELECTRIC CORPORATION, AVIATION GAS TURBINE DIVISION.

HEAD OFFICE AND WORKS: KANSAS CITY, MISSOURI.

Division Manager: W. W. Smith.

Chief Engineer: A. Chilton.

General Manager, Sales and Service: J. D. Redding.

The Westinghouse Electric Corporation began the development of aviation gas turbines in December, 1941, at the request of the U.S. Navy Bureau of Aeronautics.

The first Westinghouse jet engine, designated X19A, was the first turbojet engine in the United States to be developed exclusively from American design efforts. It was completed in March, 1943.

Among the several models since produced by Westinghouse are the J30, J34, J40 and J46 engines and their several variations.

The J34 powers a number of U.S. Navy fighter aircraft including the McDonnell F2H and Douglas F3D, and is still in production to power the new North American T2J trainer and for use in underwing pods on the Lockheed P2V-7 naval patrol bomber.

The J46 powers the Chance Vought F7U Cutlass fighter as well as the experimental Convair XF2Y-1 Sea Dart.

The latest Westinghouse engines are the J54 and XJ81, only brief details of which are available for publication.

In 1953, an eight-year agreement was signed between Westinghouse and Rolls-Royce, Ltd., of Derby, England, under which the two companies have exchanged information on the design, development and production of turbojet engines. In addition, Westinghouse have sales and manufacturing rights in America for Rolls-Royce engines other than those imported into the United States in complete aircraft.

THE WESTINGHOUSE J54-WE-2.

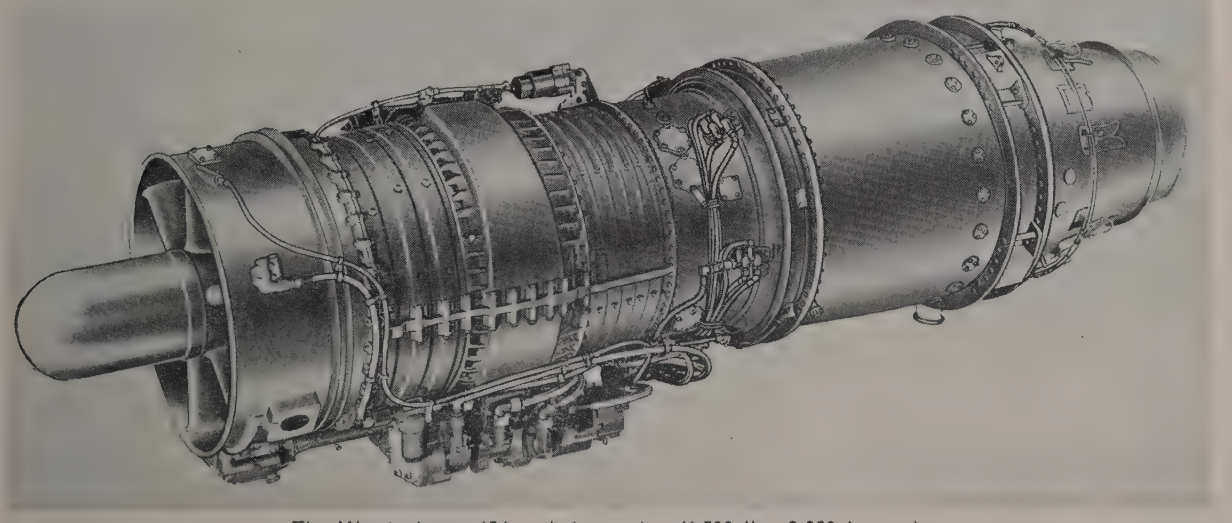
The J54 is a medium-sized lightweight axial-flow turbojet engine which was designed and developed past the 150-hour type test stage entirely at the company's own expense. It began flight tests as a podded installation slung beneath a B-45 flying test bed within 31 months of the design being started.

The J54 was designed to take full advantage of titanium metal alloys and the simplicity of its design results in correspondingly low manufacturing cost. Its compact size, long life and low fuel consumption during high altitude operation make it suitable for both commercial and military use.

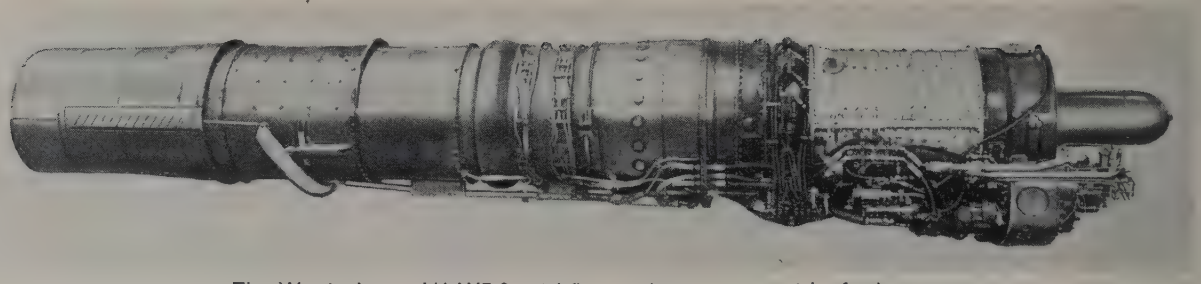
U.S. reports have stated that the J54 has a 16-stage compressor, annular combustion chamber and two-stage turbine, with a 9 : 1 compression ratio and 100 lb./sec. (45 kg./sec.) air mass flow. It was stated to have a diameter of 35 in. (890 mm.), and length of 158 in. (4,015 mm.), to weigh 1,400 lb. (635 kg.) and to have a thrust of 6,500 lb. (2,950 kg.).

THE WESTINGHOUSE J46.

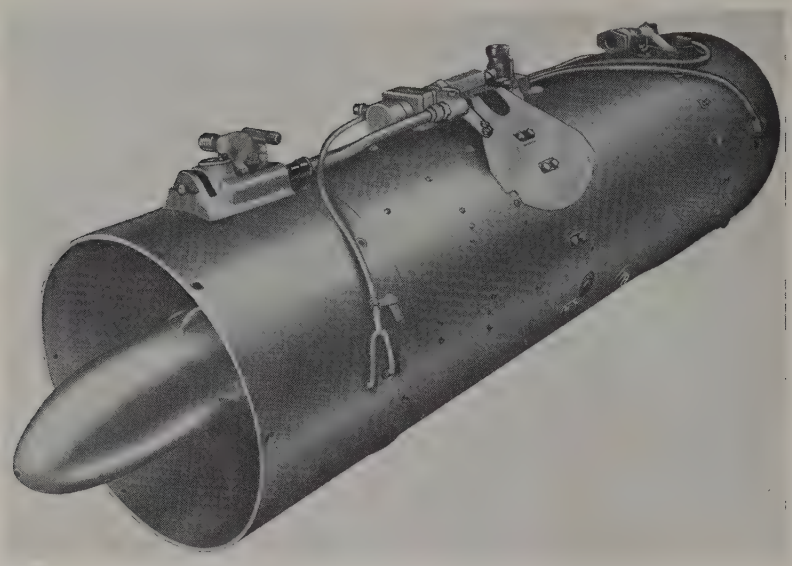
The J46 was designed as a replacement for the J34 as a power-unit for both single and twin-engined lightweight fighters. The engine passed its 50-hour flight substantiation test in November,



The Westinghouse J54 turbojet engine (6,500 lb.=2,950 kg. s.t.).



The Westinghouse J46-WE-8 axial-flow turbojet engine with afterburner.



The Westinghouse XJ81 lightweight turbojet.

1952, and its 150-hour qualification test in July, 1953.

Like all previous Westinghouse engines the J46 features an axial-flow compressor and annular combustion chamber. All other details are classified.

DIMENSIONS.—
Diameter approx. 30 in. (762 mm.)
Length about 198 in. (5,025 mm.).

WEIGHT.—
About 2,100 lb. (953 kg.).

THE WESTINGHOUSE J34-WE-46.

The J34 turbojet was put back in production in 1956, nearly ten years after the first engines of this type were delivered. The current J34-WE-46 version is scheduled for use in the new North American T2J basic trainer and as auxiliary power plants on the Lockheed P2V-7 naval patrol bomber. In addition, a commercial version known as the W-340 received C.A.A. approval for civil use in 1956.

TYPE.—Axial-flow Turbojet.

COMPRESSOR.—Eleven-stage axial-flow. Compressor casing of aluminium alloy. Compression ratio 4.35 : 1.

COMBUSTION CHAMBER.—Annular type, with stainless steel outer casing and stainless steel concentrically-mounted double perforated liner. Fuel spray nozzles on outer and inner annulars. Fuel injected downstream.

FUEL SYSTEM.—Fuel supplied to manifold in two concentric fuel rings at forward end of combustion chamber. Flyweight type all-speed fuel control.

FUEL GRADE.—JP4 or JP5.

NOZZLE GUIDE VANES.—Stationary vanes in turbine section are of cast vitalium.

TURBINE.—Two-stage axial-flow. Discs of nickel steel alloy with stellite blades.

JET PIPE.—Stainless steel fixed inner cone and outer casing.

LUBRICATION SYSTEM.—Dry sump type. Nichols gear-type pump with one pressure and five scavenge units.

ACCESSORIES DRIVE.—Gearbox mounted at vertical centre-line below engine.

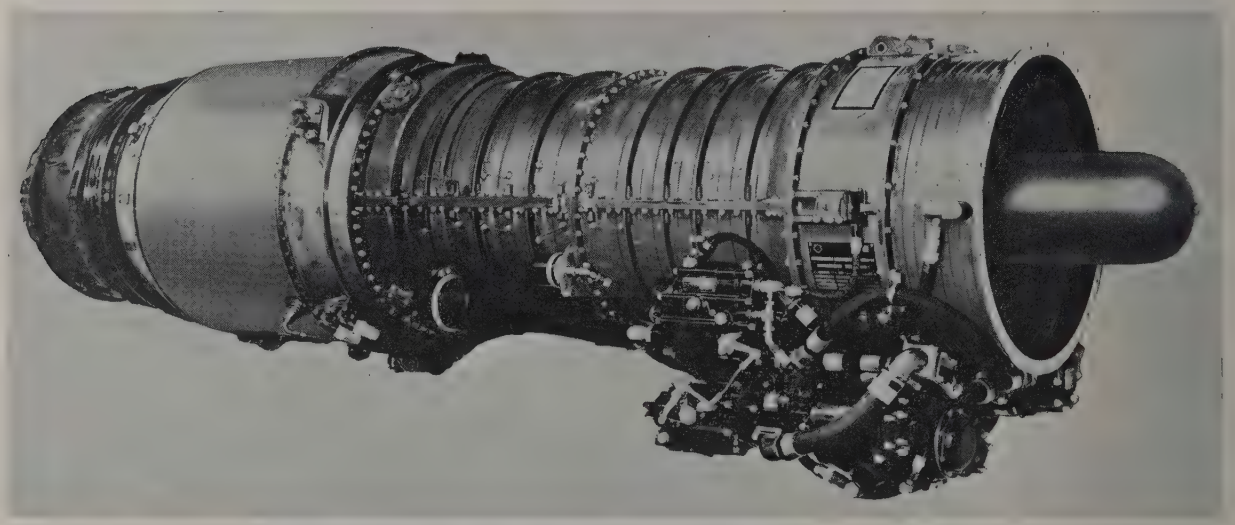
DIMENSIONS.—
Diameter 27 in. (686 mm.).
Height 34.7 in. (881 mm.).
Length 111.4 in. (2,830 mm.).

WEIGHT DRY.—
1,207 lb. (548 kg.).

PERFORMANCE RATING.—
3,400 lb. (1,542 kg.) at 12,500 r.p.m. at 45,000 ft. (13,700 m.).

THE WESTINGHOUSE XJ81-WE-3.

The XJ81 is a small lightweight axial-flow turbojet engine, basically similar to the Rolls-Royce Soar, which is intended primarily for drones and missiles. All further details are classified.



The Westinghouse J34-WE-46 turbojet engine (3,400 lb. = 1,542 kg. s.t.).

WRIGHT

WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION.

HEAD OFFICE AND WORKS: WOODRIDGE, N.J.

RESEARCH AND DEVELOPMENT CENTER: QUEHANNA, PENNA.

Chairman of the Board and President: Roy T. Hurley.

Vice-President and General Manager: J. V. Miccio.

Vice-President and Director of Engineering: Jack O. Charshafian.

The Wright Aeronautical Division of Curtiss-Wright holds licences for the manufacture of the Armstrong Siddeley Sapphire (J65) and the Bristol Olympus (J67), including special versions of the Olympus for commercial aircraft.

Production of the J65 engine was begun in 1951. This engine, fitted in some cases with an afterburner manufactured by the Solar Aircraft Company, is installed

in the Republic F-84F and RF-84F, the Martin B-57 Canberra, the North American FJ-3 and FJ-4, the Grumman F11F-1, the Douglas A4D-1, the Lockheed XF-104, the Chance Vought Regulus II flight test missile, etc. It is also earmarked for other advanced military aircraft.

Wright has two turboprop engines under development, the T49, which is a single-shaft turboprop development of the J65, and its commercial counterpart, the TP51A2.

In addition, the company is engaged actively on the development of ramjets for guided missile applications, in connection with which it opened the largest privately-owned, high-altitude, supersonic research laboratory in the world at Wood-Ridge in July, 1955.

The Curtiss-Wright Propeller Division is developing large rocket motors, one of which, the XLR25 throttleable liquid-propellent motor, powered the Bell X-2 research aircraft.

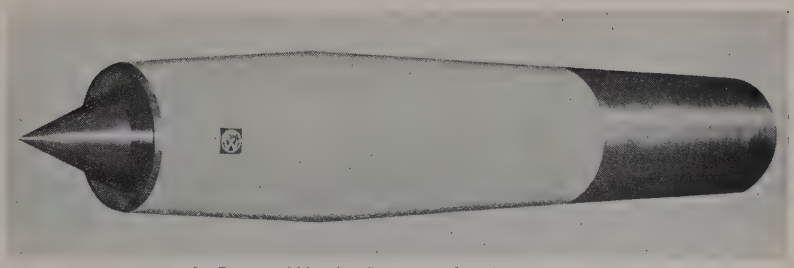
In due course, design and development of all Curtiss-Wright engines up to 7,500 lb. (3,400 kg.) s.t. for aircraft, helicopters, missiles and drones will be taken over by the newly-formed Turbomotor Division of the Curtiss-Wright Corporation at Princeton, N.J. The Wright Aeronautical Division will then concentrate solely on engines of very high power.

During 1956, Curtiss-Wright purchased from Studebaker-Packard Corporation the Aerophysics Development Corporation of Santa Barbara, Cal., which is now operated as a wholly-owned subsidiary. Aerophysics products include the highly-successful Hypersonic Test Vehicle and Dart anti-tank missile, which are described in the "Guided Missiles" section of this annual.

THE WRIGHT TJ-38 ZEPHYR.

In April, 1957, Curtiss-Wright and Bristol Aero-Engines, Ltd., signed an agreement under which the American company acquired licence rights in the Bristol Olympus BOl.6 turbojet and its derivatives. The agreement also covered development by the combined resources of both companies of an engine tailored specially for the commercial market and combining features of the Olympus BOl.6 and Orpheus turbojets.

This engine, which is now known as the Zephyr, has a take-off rating of 12,500 lb. (5,670 kg.) s.t., which remains constant up to an ambient temperature of 100°F. Important features are low noise-level and reduced weight and fuel consumption compared with other comparable turbojets. The turbine inlet temperature (1,340°F.) is also substantially lower than the current practice, to give greater reliability and longer overhaul life.



A Curtiss-Wright Ramjet of unknown identity.

The Zephyr is a two-spool turbojet, with a five-stage low-pressure compressor, seven-stage high-pressure compressor, "cannular" type combustion chamber with eight flame-tubes, single-stage high-pressure turbine and single-stage low-pressure turbine. It has a compression ratio of 10.5 : 1.

Dimensions.—
Diameter 41 in. (1,040 mm.).
Length, intake to exhaust flange 121 in. (3,075 mm.).

Weight.—
Dry, with accessories, 3,600 lb. (1,633 kg.).

Performance Ratings.—
Take-off thrust 12,500 lb. (5,670 kg.).
Cruising thrust at Mach 0.8 at 36,089 ft. (11,000 m.) 3,000 lb. (1,360 kg.).

Fuel Consumptions.—
At take-off thrust 0.718 lb./lb. s.t./hr. (0.718 kg./kg. s.t./hr.).
At cruising thrust 0.88 lb./lb. s.t./hr. (0.88 kg./kg.s.t./hr.).

THE WRIGHT TJ-37

The TJ-37 is the designation of the Bristol Orpheus 810 which Curtiss-Wright is building under licence. The Orpheus 810 (4,850 lb. = 2,200 kg. s.t.) is being offered as a standard power-unit for the Lockheed CL-329 JetStar light transport, to be replaced later by the TJ-37.

THE WRIGHT J65.

Type.—Axial-flow Turbojet.

Air Intake.—Annular type surrounding front main bearing support.

Compressor.—Thirteen-stage axial-flow, first seven stages forming low-pressure section and last six high-pressure section. Rotor blades secured in steel discs shrunk on hollow aluminium-alloy shaft. First three rows of blades are of steel and secured in discs by "fir-tree" roots. Remaining rows of blades, four of aluminium-alloy and last six of stainless steel, secured between pairs of discs by rivets. One row of inlet guide vanes and all stator blades secured by serrations in carrier rings, which are split for ease of assembly in compressor case. Inlet guide vanes and first seven rows of stator blades are shrouded. Compressor shaft carried on ball-bearing (front) and roller bearing (rear). Compressor casing, an aluminium casting, is split on horizontal centre-line.

Combustion Chamber.—Single annular type with inner and outer stainless steel liners between which combustion takes place. Thirty-six Armstrong Siddeley type fuel-air vaporisers. Fuel and primary air fed into hook-shaped vaporiser tubes whose open ends point upstream. Secondary air enters chamber through 36 air distributing cups to mix with combustion flame near vaporiser tubes.

Fuel System.—Low pressure type.

Fuel Grade.—Mil-L-5624A (JP4).

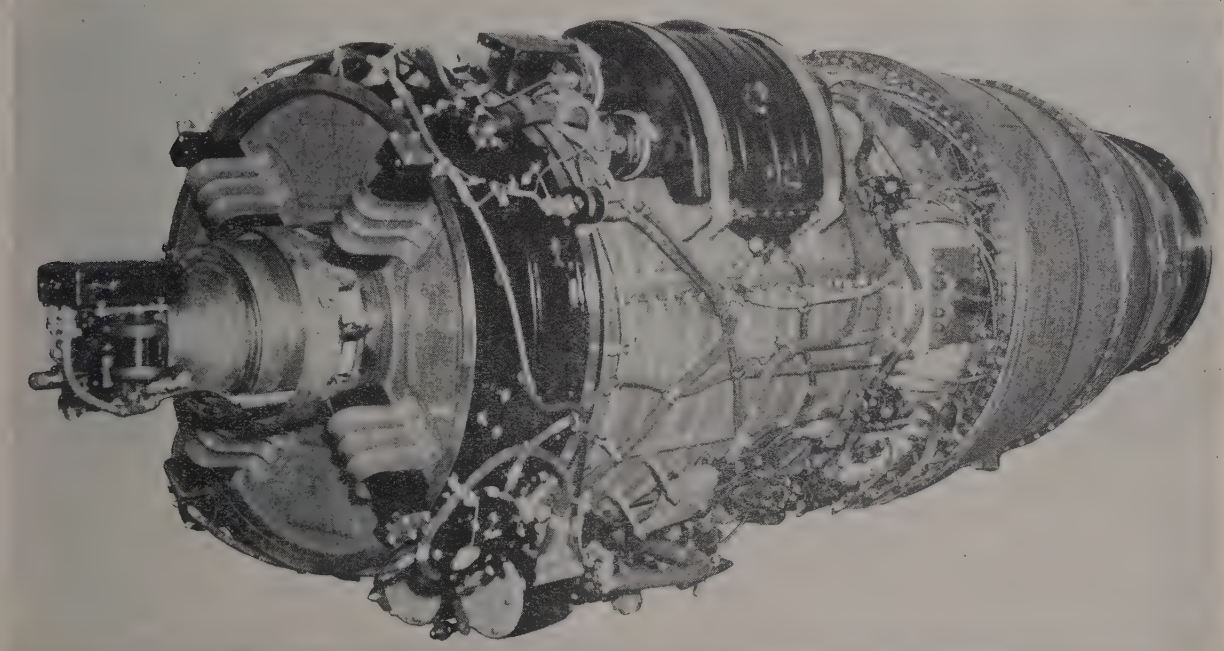
Nozzle Guide Vanes.—Aerofoil type.

Turbine.—Two-stage turbine. Steel discs coupled together by taper pins. First-stage disc has 110 buckets, second-stage 75 buckets, all secured by "fir-tree" roots and locking plates. Blades of nickel-base alloy. Front turbine disc attached by taper pins to turbine rotor stub shaft. This is splined to turbine rotor shaft coupling, front end of turbine rotor shaft, in turn, being bolted to compressor rotor shaft drive coupling. Roller bearing in front of rotor disc assembly. Gas temperatures 1,476°F. before turbine, 1,112°F. after turbine.

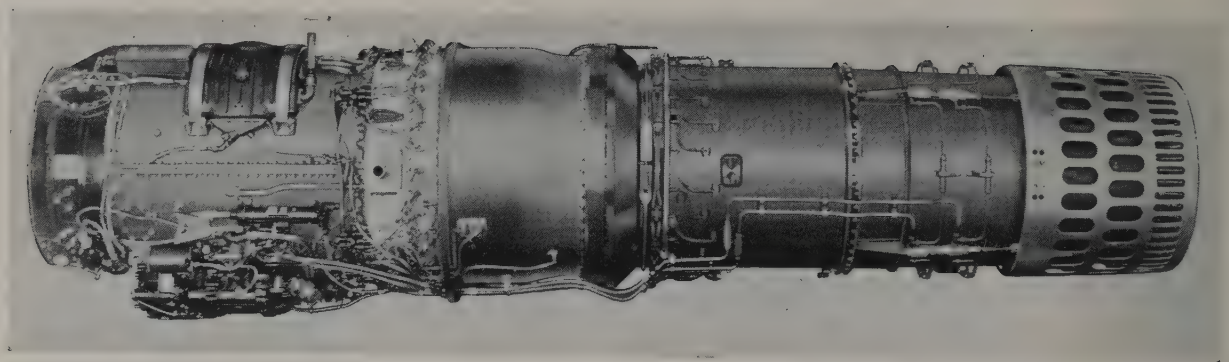
Jet Pipe.—Fixed type. Steel jet pipe and inner cone.

Accessory Drive.—Off extension of compressor shaft in front main bearing support.

Lubrication System.—Closed system. Oil tank (5 U.S. gallons = 18.9 litres capacity) located on upper port side of compressor casing. One gear-type pressure pump,



The Wright J65-W-7 axial-flow turbojet engine which has a thrust rating of 7,800 lb. (3,538 kg.).



The Wright J65 turbojet engine with afterburner.

WRIGHT J65 ENGINE DATA.

Engine Model	S/L. Static Thrust (dry)	S/L. Static Thrust (augmented)	Dry weight less tailpipe	Length with tailpipe	Maximum Diameter	Remarks
J65-W-5	7,200 lb. (3,266 kg.)	—	2,750 lb. (1,247 kg.)	109 in. (2,769 mm.)	37.5 in. (953 mm.)	In Martin B-57A and B, RB-57A
J65-W-6	—	11,000 lb. (4,990 kg.)	3,485 lb. (1,581 kg.)	184 in. (4,674 mm.)	37.5 in. (953 mm.)	
J65-W-7	7,800 lb. (3,538 kg.)	—	2,795 lb. (1,268 kg.)	115 in. (2,921 mm.)	37.5 in. (953 mm.)	In Republic XF-84F
J65-W-14	—	10,000 lb. (4,536 kg.)	3,535 lb. (1,603 kg.)	181 in. (4,597 mm.)	37.5 in. (953 mm.)	
J65-W-16	7,700 lb. (3,493 kg.)	—	2,742 lb. (1,244 kg.)	113 in. (2,870 mm.)	37.5 in. (953 mm.)	In North American FJ-3 and FJ-4
J65-W-18	—	10,000 lb. (4,536 kg.)	3,485 lb. (1,581 kg.)	181 in. (4,597 mm.)	37.5 in. (953 mm.)	In Grumman F11F-1

one gear-type scavenge pump and two piston-type metering pumps. Normal oil pressure 24-40 lb./sq. in. (1.69-2.81 kg./cm.^{2}).

Oil Specification.—Mil-L-7808.

Mounting.—Three-point suspension, one stabilising support at front and two trunnions at centre main bearing support on horizontal centre-line.

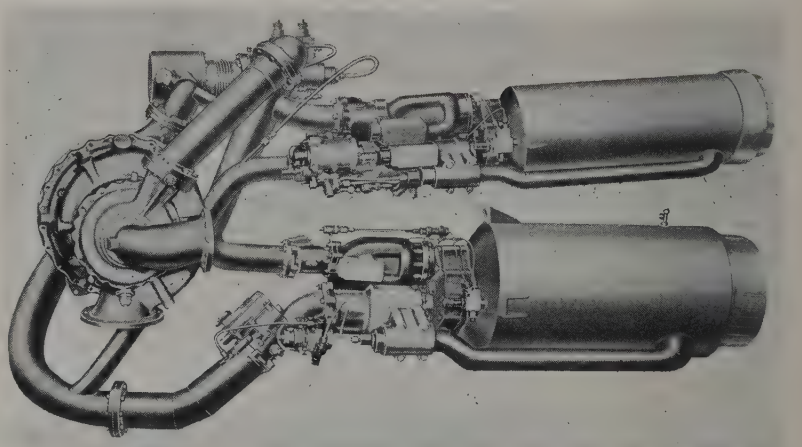
Starting.—Combustion cartridge or electric starter/generator in bullet fairing on nose. Primers and igniters in combustion chamber. Electrical and ignition systems interconnected for automatic starting.

Dimensions, Weights and Performance Ratings.—See Table.

THE WRIGHT T49 (TP51A2).

The T49 is a shaft-drive engine based on the J65, but has a third turbine stage and a large reduction gearbox centrally mounted in the intake casting.

Two Boeing XB-47D Stratojets were used for flight tests, with a YT-49 replacing each inner pair of J47 turbojets. These YT-49 engines are rated at about 10,380 e.h.p. each and drive Curtiss Turbolectric airscrews with ducted spinners. The civil version, designated TP51A2, will be derated to maintain 6,500 s.h.p. up to 25,000 ft. (7,620 m.), running at peak temperatures some 300°F. (150°C.) under those of the fully-rated version.



The Curtiss-Wright XLR25-CW-1 throttleable liquid-propellent rocket motor.

THE CURTISS-WRIGHT XLR25-CW-1.

The XLR25 is a throttleable liquid-propellent rocket motor which the Curtiss-Wright Propeller Division developed for the Bell X-2 ultra-high-speed research aircraft. It has one large and one small regeneratively-cooled chambers, into which the propellents are fed by a turbo-pump group driven by a self-contained system, under the control of pilot-operated electro-hydraulic throttles. The main chamber is rated at approximately 8,000 lb. (3,630 kg.) s.t. and the auxiliary (cruising) chamber at 4,000 lb. (1,815 kg.) s.t.

PART 2—PISTON ENGINES

GREAT BRITAIN

ALVIS

ALVIS LTD.

HEAD OFFICE AND WORKS: HOLYHEAD ROAD, COVENTRY.

Directors: J. J. Parkes, F.R.Ae.S. (Chairman and Managing Director), R. W. Rutledge, H. J. Nixon, Lieut.-Col. J. C. Chaytor and Capt. H. S. Harrison-Wallace, D.S.O., R.N. (Retd.).

Sales Manager, Aero Division: T. C. Wallace.

Long famous for its motor cars, the Alvis company decided to form an aero-engine division towards the middle of 1935. Its current products are the nine-cylinder Leonides and 14-cylinder Leonides Major, both of which are available for fixed-wing installations and as power plants for helicopters with either right or left-hand rotation.

The Leonides powers a wide variety of aircraft and in the Hunting Percival Provost basic trainer alone had built up a total of over one million flying hours with the R.A.F. Flying Training Command by the Spring of 1957. On the civil side, it is coming into service in the Scottish Aviation Twin Pioneer.

The Leonides Major powers the later Westland Whirlwind helicopters entering service with the Royal Navy and is installed in one version of the Handley Page Herald branch airliner.

THE ALVIS LEONIDES.

TYPE.—Nine-cylinder radial air-cooled, geared and supercharged.

CYLINDERS.—Bore 4.8 in. (122 mm.). Stroke 4.41 in. (112 mm.). Capacity 718.6 cub. in. (11.78 litres). Compression ratio 6.5 : 1. Nitrided steel barrels with cast Y-alloy heads screwed and shrunk on. Both barrels and heads are deeply finned.

PISTONS.—Forged Y-alloy with internal finning below crown. Two compression and two scraper rings, one scraper at skirt rest above gudgeon-pin. Fully-floating gudgeon-pins with washers and circlips.

CONNECTING RODS.—I-section master-rod and I-section auxiliary rods machined from high-grade steel. Master-rod has white-metalled steel shell big-end bearing. All other bearings have bronze bushes.

CRANKSHAFT. — Single-throw shaft with divided crank-pin. The divided pin is serrated internally for a mating and serrated steel coupling. Shaft runs in two uncaged roller bearings and one ball thrust bearing.

CRANKCASE.—Cast in two halves in L.51 alloy.

VALVE GEAR.—Two inclined valves per cylinder with independent rocker system completely enclosed. Both valves of austenitic steel, the exhaust valve sodium-cooled and with "bright-ray" covered head and seats. Cam-ring two-track cam disc, each track with four cams operating roller followers housed in removable tappet guides in crankcase.

INDUCTION.—Hobson automatic low-pressure fuel injector. Induction system incorporates air-cleaning and de-frosting with oil-heated throttles and throttle housing.

SUPERCHARGER.—Single-speed single-stage centrifugal blower. Supercharger ratio 6.5 : 1.

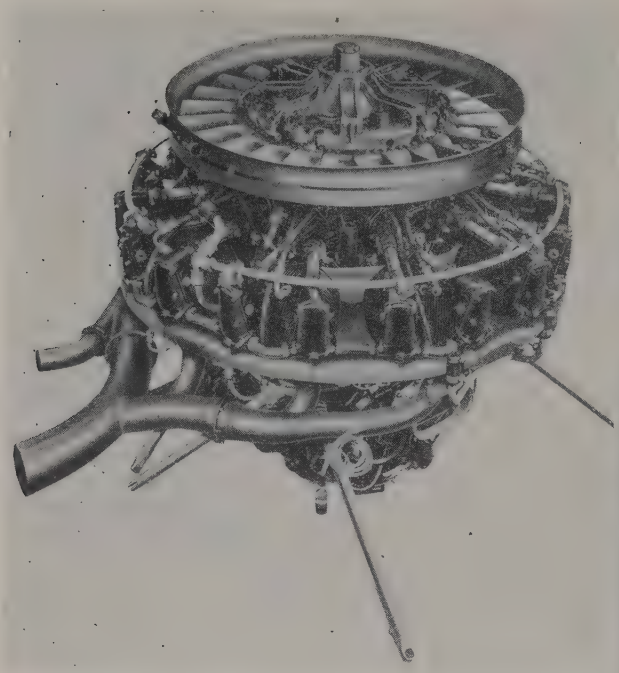
FUEL.—100/130 Grade (DERD 2485). Lower grades can be used after incorporation of minor modifications.

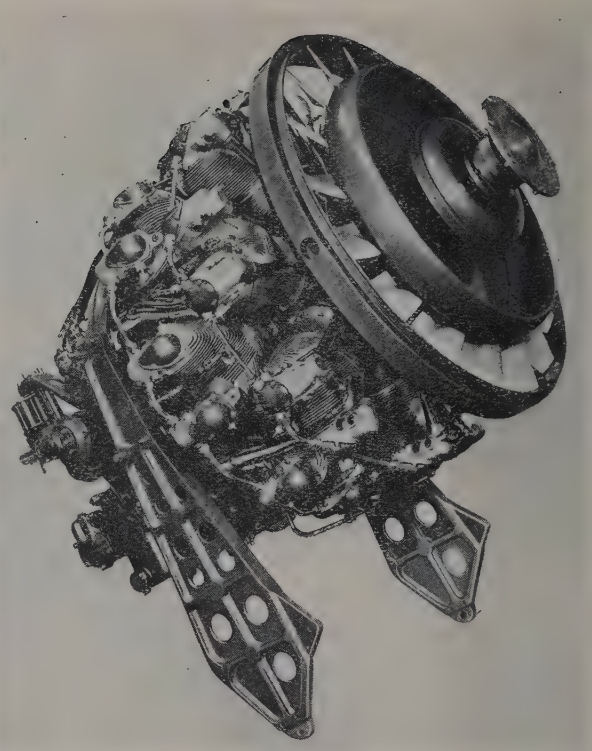
IGNITION.—Two B.T.H. type C.9B/2 (C.9A/3 in Type 521/1 and 523/1 engines) magnetos mounted on rear cover and driven by B.T.H. couplings. Two plugs per cylinder, Lodge type LA.1/2. Plessey fully-screened harness.

LUBRICATION.—Dry sump system. One pressure pump and two scavenge pumps. Normal oil pressure 60-80 lb./sq. in. (4.2-5.6 kg./cm.^{2}). Inlet temperature (max.)

ALVIS LEONIDES AND LEONIDES MAJOR RADIAL AIR-COOLED ENGINES.

Model	Bore and Stroke	Swept Volume	Take-off Power	Max. Continuous Rating	Max. Power Rating	Nett Dry Weight	Reduction Gear Ratio	Dimensions		Remarks
								Diameter	Length	
Leonides 503/4	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	795 lb. (361 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Leonides 503/5 similar except dry weight 800 lb. (363 kg.)
503/6 and 503/7	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	810 lb. (367 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Leonides 503/8 similar except reduction gear ratio .5 : 1
504/5	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	490 h.p. at 3,750 ft. (1,140 m.)	545 h.p. at 1,750 ft. (535 m.)	800 lb. (363 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	—
504/7	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	490 h.p. at 3,750 ft. (1,140 m.)	545 h.p. at 1,750 ft. (535 m.)	810 lb. (367 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Leonides 504/8 similar except reduction gear ratio .5 : 1
514/7	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	540/560 h.p.	500 h.p. at 3,750 ft. (1,140 m.)	570 h.p. at 1,750 ft. (535 m.)	810 lb. (367 kg.)	.625 to 1	41.5 in. (1,054 mm.)	54.4 in. (1,382 mm.)	Leonides 514/8 similar except reduction gear ratio .5 : 1
521/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	480/500 h.p.	405 h.p. at 8,250 ft. (2,515 m.)	515 h.p. at 3,750 ft. (1,140 m.)	790 lb. (358 kg.)	.8 : 1	41.5 in. (1,054 mm.)	54.96 in. (1,397 mm.)	Vertical mounting
523/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520/540 h.p.	460 h.p. at 6,000 ft. (1,830 m.)	545 h.p. at 1,750 ft. (535 m.)	790 lb. (358 kg.)	.8 : 1	41.5 in. (1,054 mm.)	54.96 in. (1,397 mm.)	Vertical mounting
524/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	500/520 h.p.	390 h.p. at 9,250 ft. (2,820 m.)	540 h.p. at 4,750 ft. (1,450 m.)	730 lb. (331 kg.)	Nil	41.5 in. (1,054 mm.)	32.8 in. (833 mm.)	Vertical mounting
Leonides Major 702/1	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	1,118.4 cub. in. (18.33 litres)	875 h.p.	735 h.p. at 6,500 ft. (1,980 m.)	885 h.p. at 1,500 ft. (460 m.)	1,200 lb. (545 kg.)	.533 to 1	38.9 in. (988 mm.)	62.1 in. (1,575 mm.)	—
Leonides Major Mk. 151	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	1,118.4 cub. in. (18.33 litres)	—	690 h.p. at 7,000 ft. (2,135 m.)	860 h.p. at 1,000 ft. (305 m.)	1,050 lb. (476 kg.)	Nil	38.9 in. (988 mm.)	54.9 in. (1,394 mm.)	Vertical mounting
Leonides Major Mk. 155	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	1,118.4 cub. in. (18.33 litres)	—	685 h.p. at 7,500 ft. (2,280 m.)	780 h.p. at 4,250 ft. (1,295 m.)	1,050 lb. (476 kg.)	Nil	38.9 in. (988 mm.)	54.9 in. (1,394 mm.)	Vertical to horizontal





Above, the Alvis Leonides 521/1 and, right, the Leonides Major helicopter engines.

85°C. Outlet temperature (approx.) 110°C. Normal oil flow 300 gallons (1,364 litres) per hour.

REDUCTION GEAR.—Farman type epicyclic. Gear ratio 0.625 : 1 or 0.50 : 1.

AIRSCREW SHAFT.—No. 3 size L.H. rotation. Constant-speed governor unit driven through bevels mounted on front of cam gearing drive-shaft. Operating oil passes through annular channels and drilling in special oil transfer unit located inside stationary bevel of reduction gear.

ACCESSORIES.—Mounted on rear cover and comprising Newton type HX2 generator, Smiths Mk. VIIIB r.p.m. drive, Hymatic type SH 6/10C air compressor with Rotol half-speed gearbox type ARG1/8E, Lockheed Mk. VI Series 1 hydraulic pump and Plessey B.3X Mk. II vacuum pump.

MOUNTING.—Dynafocal flexible type with four pin-jointed attachments.

STARTING.—Plessey cartridge, or Rotax hand/electric starter (with feathering pump drive on all engine types except 521/1 and 524/1).

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

CONSUMPTIONS.—
Fuel (at max. continuous power) 48.5 Imp. gallons (220.5 litres) per hour.
Oil 4 to 9 pints (2.2 to 5.1 litres) per hour.

THE ALVIS LEONIDES HELICOPTER ENGINE.

There are two versions of this engine, of which the Series 524 powers the Bristol Type 171 helicopter and the Series 521 the Westland Dragonfly helicopter. The differences are as follows :—

Series 521. Basically as standard Leonides, but with crankshaft arranged to run vertically. Fitted with 0.8 : 1 reduction and reversing gear giving right-hand rotation.

Series 524. Basically similar to the standard Leonides, but with the oil pumps and sump mounted in the rear cover in order that the engine can run with the crankshaft in the vertical plane. No reduction gear is fitted, but in its place is a centrifugally-operated clutch with integral cooling fan blades.

THE ALVIS LEONIDES MAJOR.

There are two basic versions of the Leonides Major, for fixed-wing aircraft and for helicopter installations. The description below refers specifically to the fixed-wing version, the helicopter version being described individually later under its own heading.

TYPE.—14-cylinder two-row air-cooled radial, geared and supercharged.

CYLINDERS.—Bore 4.80 in. (122 mm.). Stroke 4.41 in. (112 mm.). Swept volume 1,117.8 cub. in. (18.34 litres). Compression ratio 6.8 : 1. Nitrided steel barrels, deeply finned, with cast "Y" alloy heads screwed and shrunk on.

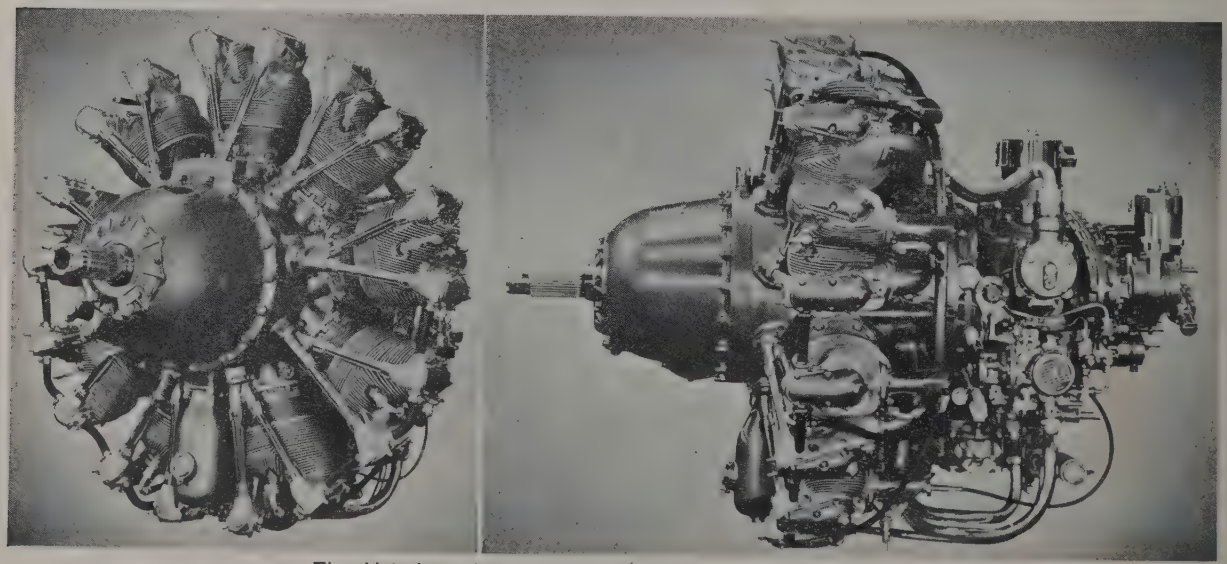
PISTONS.—Forged "Y" alloy, with internal finning below crown. Two compression and two scraper rings, one scraper at skirt, rest above gudgeon-pin. Fully-floating gudgeon-pins with washers and circlips.

CONNECTING RODS.—I-section master-rods and I-section auxiliary rods machined from high-grade steel. Master-rods have white-metalled steel shell big-end bearings; all other bearings have bronze bushes.

CRANKSHAFT.—Two-throw three-piece shaft machined from high-grade steel. Three roller bearings and one ball-bearing to govern end float.

CRANKCASE.—Three-piece case die-forged in light alloy.

VALVE GEAR.—Two inclined valves per cylinder. Both valves of austenitic steel, exhaust valve sodium-cooled and with Brightray-covered head and seats. Two double-tracked cam discs, each track with three cams operating roller followers.



The Alvis Leonides nine-cylinder radial air-cooled engine.

INDUCTION.—Low-pressure fuel injection. Hobson or S.U. fuel pump and fuel injectors.

SUPERCHARGER.—Single-stage single-speed centrifugal blower. Spring drive. Gear ratio 6.5 : 1.

FUEL. — 100/130 Grade (DERD 2485). Lower grades can be used after incorporation of minor modifications.

IGNITION.—Two B.T.H. Type C.14.C/1 magnetos on rear cover. Two Lodge LA1/2 plugs per cylinder. Plessey fully-screened ignition harness.

LUBRICATION.—Dry sump type. One pressure pump and two scavenge pumps.

REDUCTION GEAR.—Farman type epicyclic gear with fixed bevel and six satellite pinions. Gear ratio 0.533 : 1.

AIRSCREW SHAFT.—No. 4 size L.H. rotation.

ACCESSORY DRIVE.—Provision for all normal accessories on rear cover, with direct drive.

ACCESSORIES.—Rotax type B.2104 generator, Smiths type VIIIC r.p.m. drive, Hymatic type S.50U or Dunlop Mk. 1 air compressor, Lockheed Mk. VII Series 1 hydraulic pump, Plessey B.3X Mk. II vacuum pump.

STARTING.—Rotax hand/electric type C.1254 or Plessey cartridge M.5 Mk. 2 or M.6 Mk. 2.

MOUNTING.—Dynafocal mounting with four pick-up points.

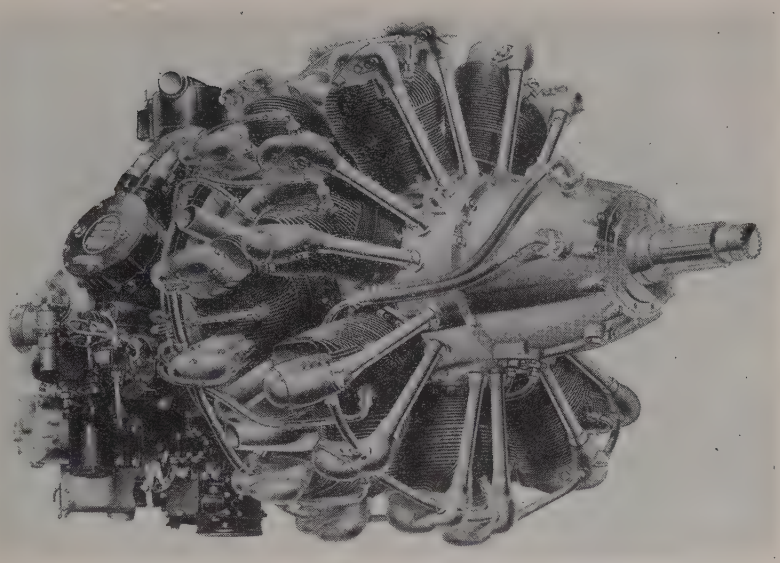
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

CONSUMPTIONS.—
Fuel (at max. continuous power) 69.4 Imp. gal. (297 litres) per hour.
Oil 6-12 pints (3.4-6.8 litres) per hour.

THE ALVIS LEONIDES MAJOR HELICOPTER ENGINE.

There are two versions of this engine. That used in the Bristol 173 and 191/2 Series helicopters is similar to the standard Leonides Major, but with crankshaft arranged to run vertically. There is no reduction gear but it is fitted with either a centrifugal or manually operated clutch with integral cooling fan.

The second version, used in the Westland Whirlwind H.R. Mk. 5, is arranged for right-hand rotation, and fitted with clutch and cooling fan. The positioning of the sump and oil pumps enables this engine to run in any position between vertical and horizontal to suit the aircraft installation.



The 875 h.p. Alvis Leonides Major two-row radial engine.

BRISTOL

BRISTOL AERO-ENGINES, LTD.

HEAD OFFICE, WORKS AND AERODROME : FILTON, NR. BRISTOL.

LONDON OFFICE : 6, ARLINGTON STREET, ST. JAMES'S, S.W.1.

Directors : Sir W. Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Chairman and Managing Director) ; Sir W. Reginald Verdon Smith, M.A., B.C.L., J.P. ; Brian Davidson ; F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E., F.Inst.Pet. ; Dr. S. G. Hooker, O.B.E., D.Phil., D.I.C., F.R.Ae.S. (Chief Engineer) ; G. L. Hack, M.I.Mech.E. (Works Director) ; John Innes, O.B.E., M.A. ; R. L. Ninnes, F.R.Ae.S. ; Dr. E. Warlow Davies, D.Phil., B.A., B.Sc. (Deputy Chief Engineer) ; F. M. Burns (Financial).

General Manager : D. A. Fairnie, B.Sc., M.I.Prod.E.

Secretary : D. Railton.

The Bristol Aeroplane Co., Ltd. was originally founded in 1910 but it did not enter the aero-engine field until 1920, when an Aero-engine Department was established to design and manufacture radial air-cooled engines.

With the progressive growth of the company's aviation activities at home and abroad, the Bristol Aeroplane Co., Ltd. decided late in 1955 to transfer the activities of its individual divisions to the control of separate subsidiary companies. As part of the re-organisation, a new company known as Bristol Aero-Engines, Ltd. was incorporated. It took over the assets and liabilities of the Aero-Engine Division on January 1, 1956.

In addition to the headquarters factory at Filton, the company has a components factory at Sunderland, overhaul base at Whitchurch and satellite drawing offices in London and Cardiff.

During the last war the Bristol company and its shadow factories produced over 100,000 engines, of which 57,400 were Hercules and 2,500 were Centaurus engines.

The first post-war range of Bristol civil engines were in the Hercules 630 Series. These engines were essentially similar to the military Hercules 100 Series except that they had single-speed superchargers.

These engines were followed by the post-war 200 and 700 Series which had many new features, including copper-based cylinder-heads and a stiffened power section. The most prominent engines in this Series have been the military Mks. 230 and 264 and the civil Mks. 730, 733, 734, 758, 763 and 773.

The Hercules 800 Series have a further stiffening of the power section and, with water/methanol injection, develop 2,300 h.p. for take-off.

Hercules 106 engines which powered the Handley Page Hastings transport are now being replaced by a new version of this engine, the Mk. 216, to provide better performance and a longer period between overhauls.

The civil 630 Series engines have been used in the Short Solent, Vickers Viking and Bristol Freighter. These engines have an approved overhaul life of 1,400 hours, and this period is likely to increase. The 730 Series engine powers the Spanish CASA Azor transport.

The immediate post-war Centaurus engines were the Mks. 18 and 57. The full post-war types were introduced initially in 1949 and comprised the civil 660 Series and, in 1953, the military Mk. 173.

The Centaurus 661 is employed in the Airspeed Ambassador, or "Elizabethan" class, airliners and is approved for a life of 1,700 hours between overhauls. This period is due to be increased further as a result of trials that were being conducted at the time of writing. The military version, the Centaurus 173, is in production for the Blackburn Beverley heavy freighter for the R.A.F. A later development of this engine, the Centaurus 373, is fitted with a direct fuel-injection system and, with methanol/water injection, develops 3,150 h.p. for take-off.

It is worth noting that all Bristol engines have a name and mark number. Mark numbers below 500 are applied to military engines, while numbers above 500 distinguish civil engines.

Details of Bristol gas-turbine engines will be found in Part I of this Section.

THE BRISTOL CENTAURUS.

The latest marks of Centaurus civil engines are of the 660 series and have two-speed superchargers. They are fitted with copper-based cylinder heads, and embody the necessary drive and face for an airscrew reversing pump, together with a 150 h.p. accessory drive.

The following are the principal current versions of the Centaurus :—

Centaurus 660 Series. Twin-entry two-speed supercharged engines with front ignition system, provision for feathering and reversing airscrew, copper-based cylinder heads and high-power accessory drive (150 h.p.). The engine is mounted on a dynamic-type flexible mounting.

Centaurus 173. Twin-entry single-speed supercharged engine with dynamic flexible mounting, copper-based head, methanol-water injection, etc.

Centaurus 373. Basically similar to the Centaurus 173, but having a direct fuel-injection system instead of the bulk fuel injector. Two nine-cylinder pumps at the rear of the engine supply metered fuel to the injection nozzles, one in each cylinder-head. As with the bulk injector, pump output is controlled by engine r.p.m., supercharger pressure and temperature, and exhaust back pressure.

The description which follows refers to the Type 173.

TYPE.—Eighteen-cylinder two-row air-cooled sleeve-valve radial with single-speed supercharger.

CYLINDER ASSEMBLY.—Bore 5.75 in. (146 mm.). Stroke 7 in. (178 mm.). Swept volume 3,270 cub. in. (53.6 litres). Open ended light alloy barrels with deep closely pitched fins, machined from solid. Cylinder heads fabricated, with finned copper base and steel body.

SLEEVE DRIVE.—By simple spur gear trains from front and rear ends of crankshaft, driving short cranks for the front and rear banks respectively. Each sleeve crank is carried at one end in a plain bearing in the crankcase, and at the other end in a plain bearing in the enclosing casing, through which pressure oil is supplied for the sleeve ball assemblies. The cranks run at one-half engine speed. Intermediate gears are carried on needle roller-bearings.

PISTONS.—Fully skirted type, with two wedge-section gas rings and a scraper ring above the gudgeon-pin and one bevelled scraper ring in the skirt. Fully-floating

gudgeon-pins in pistons and small-ends of connecting-rods.

CONNECTING RODS.—Front and rear assemblies each comprising a master-rod, bearing directly on the white-metalled crankpin sleeve, and eight articulated rods carried in the master-rod.

CRANKSHAFT.—Three-piece built-up type carried in four roller main bearings. Crankpins formed integral with centre-section, and fitted with white-metalled steel sleeves for big-end bearings.

CRANKCASE.—In three sections, carrying housing for the main bearings and sleeve crank bearings.

FRONT COVER.—Encloses the front bank sleeve-drive mechanism and has a flange and drive for the combined constant-speed unit and airscrew reversing pump, and ignition distributors. There is a small oil pump in the base of the casting to return surplus oil from the front of the engine to the sump.

SUPERCHARGER AND INDUCTION SYSTEM.—Single-speed centrifugal supercharger, housed in a light-alloy casing. The aluminium-alloy impeller is of the double-shrouded type, and has a guide vane rotor mounted with it as an integral unit on the hollow alloy-steel impeller shaft. The drive to the impeller shaft is taken from the rear of the crankshaft through spur gear trains. A vaned diffuser ring encircling the impeller passes the compressed mixture to the annular diffuser chamber formed in the supercharger casing, whence eighteen aluminium-alloy induction pipes lead to the cylinders. The supercharger casing incorporates drives and faces for engine accessories, including the ignition generators, the fuel-pump and the electric starter. The engine rear cover is replaced by a simple plate which encloses the rear of the supercharger, and provides a bearing for the 150 h.p. accessory drive.

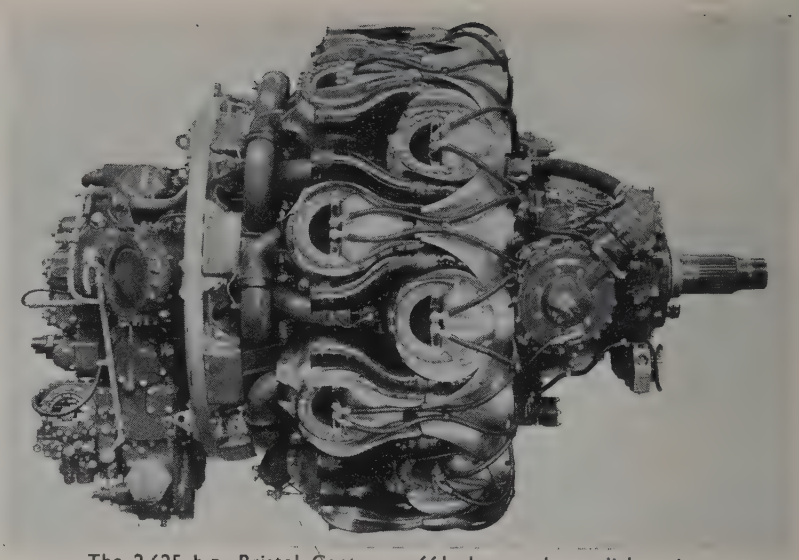
FUEL SYSTEM.—A Hobson-R.A.E. injector is fitted, supplying two spray nozzles, one in each intake trunk. The fuel pump is an integral part of the injector and is driven from a gear train in the supercharger casing.

IGNITION SYSTEM.—Twin L.T. generators mounted at the rear of the engine supply twin H.T. transformers and distributors on the front cover. Two plugs in each cylinder are separately supplied by each distributor through leads enclosed in a waterproof screened harness.

LUBRICATION SYSTEM.—Direct pressure lubrication from oil pump in the sump through hollow main driving shaft and crankshaft to supply pressure oil to the supercharger, big end bearings and reduction gear. Separate pressure lines delivering oil to the sleeve driving mechanism. Pistons and sleeve splash-lubricated and supplemented by oil jets in the crankshaft. Oil in sump returned to tank by scavenge pump which is integral with pressure pump.

REDUCTION GEAR.—Epicyclic bevel type with a ratio of 0.40 : 1. The gears are located by spherical seats, spreading the load evenly over the three bevel pinions. Rear bevel wheel is driven from the crankshaft through a toothed coupling. All engines bearing an odd type number (*e.g.* Centaurus 173 etc). have a torquemeter built integral with the reduction gear.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.



The 2,625 h.p. Bristol Centaurus 661 sleeve-valve radial engine.

THE BRISTOL HERCULES.

The Hercules is by far the most widely used of the Bristol sleeve-valve engines. There are many types, which divide into the following main current groups :—

Hercules 630 and 670 Series. Single-speed supercharged civil versions of the Hercules 100.

Hercules 230 Series. Single-speed supercharger, copper-based cylinder heads and stiffened power section, for military applications.

Hercules 730 Series. Civil version of Hercules 230 Series.

Hercules 750 Series. Similar to Hercules 730 Series, but with provision for reversing airscrews and 36 h.p. accessory drive. The Hercules 758 is being built under licence in France by S.N.E.C.M.A.

Hercules 760 Series. Two-speed supercharged civil engine, with copper-based cylinder heads, provision for reversing airscrews and 150 h.p. accessory drive. Rated on 115/145 grade fuel.

Hercules 770 Series. Similar to Hercules 760, but rated on 100/130 Grade fuel, and with methanol/water injection for take-off. Supercharger locked in low gear.

Hercules 260 Series. Military version of Hercules 760 Series.

Hercules 815 Series. Similar to 750 Series but stiffened for higher rating and using water/methanol injection.

The description which follows refers to the Hercules 815.

BRISTOL CENTAURUS SLEEVE-VALVE RADIAL ENGINES.

	Bore and Stroke	Capacity	Airscrew Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Fuel Grade
CENTAURUS 661 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	3,460 lb. (1,570 kg.)	2,625 h.p. at 2,800 r.p.m.	2,705 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.)	2,265 h.p. at 2,500 r.p.m. at 5,500 ft. (1,680 m.) and 2,110 h.p. at 2,500 r.p.m. at 12,000 ft. (3,660 m.)	1,675 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.) and 1,575 h.p. at 2,400 r.p.m. at 17,500 ft. (5,335 m.)	100/130
CENTAURUS 662 and 663 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	Mk. 662 3,430 lb. (1,556 kg.) Mk. 663 3,465 lb. (1,572 kg.)	2,850 h.p. at 2,800 r.p.m. with methanol water	2,910 h.p. at 2,800 r.p.m. at 2,750 ft. (840 m.) with methanol water	2,265 h.p. at 2,500 r.p.m. at 5,500 ft. (1,680 m.) and 2,110 h.p. at 2,500 r.p.m. at 12,000 ft. (3,660 m.)	1,675 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.) and 1,575 h.p. at 2,400 r.p.m. at 17,500 ft. (5,335 m.)	100/130
CENTAURUS 173 (Military) and 673 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	3,400 lb. (1,542 kg.)	2,850 h.p. at 2,800 r.p.m. with methanol water	2,935 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) with methanol water	2,390 h.p. at 2,500 r.p.m. at 4,500 ft. (1,370 m.)	1,720 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.)	100/130
CENTAURUS 373 (Military) and 873 (Civil)	5¾ in. × 7 in. (146 mm. × 178 mm.)	3,270 cub. in. (53.6 litres)	0.400 : 1	55.3 in. (1.405 m.)	3,490 lb. (1,583 kg.)	3,150 h.p. at 2,800 r.p.m. with methanol water	3,220 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.) with methanol water	2,590 h.p. at 2,600 r.p.m. at 5,500 ft. (1,680 m).	1,890 h.p. at 2,500 r.p.m. at 11,500 ft. (3,510 m.)	100/130

BRISTOL HERCULES SLEEVE-VALVE RADIAL ENGINES.

	Bore and Stroke	Capacity	Air-screw Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Fuel Grade
HERCULES 634 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 634 1,945 lb. (882 kg.) Mk. 638 1,955 lb. (886 kg.)	1,690 h.p. at 2,800 r.p.m.	1,780 h.p. at 2,800 r.p.m. at 6,500 ft. (1,981 m.)	1,510 h.p. at 2,400 r.p.m. at 3,750 ft. (1,143 m.)	1,315 h.p. at 2,400 r.p.m. at 8,250 ft. (2,514 m.)	100/130
HERCULES 637 and 672 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 637 1,980 lb. (898 kg.) Mk. 672 1,955 lb. (886 kg.)	1,690 h.p. at 2,800 r.p.m.	1,780 h.p. at 2,800 r.p.m. at 6,500 ft. (1,981 m.)	1,590 h.p. at 2,500 r.p.m. at 5,250 ft. (1,600 m.)	1,320 h.p. at 2,400 r.p.m. at 8,500 ft. (2,590 m.)	100/130
HERCULES 230 and 270 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 230 2,115 lb. (960 kg.) Mk. 270 2,135 lb. (959 kg.)	1,925 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,800 r.p.m. at 5,000 ft. (1,524 m.)	1,650 h.p. at 2,400 r.p.m. at 3,250 ft. (990 m.)	1,270 h.p. at 2,400 r.p.m. at 10,250 ft. (3,124 m.)	100/130
HERCULES 234 (Military) and 734 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mks. 234, 734 2,115 lb. (960 kg.) Mks. 235, 735 2,150 lb. (975 kg.)	1,980 h.p. at 2,800 r.p.m.	2,020 h.p. at 2,800 r.p.m. at 2,750 ft. (838 m.)	1,660 h.p. at 2,500 r.p.m. at 4,500 ft. (1,372 m.)	1,220 h.p. at 2,400 r.p.m. at 10,500 ft. (3,200 m.)	100/130
HERCULES 733, 737, 758, 759 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mks. 733, 737, 2,150 lb. (975 kg.) Mk. 758, 2,175 lb. (986 kg.) Mk. 759, 2,200 lb. (998 kg.)	2,040 h.p. at 2,800 r.p.m.	2,090 h.p. at 2,800 r.p.m. at 3,000 ft. (914 m.)	1,670 h.p. at 2,500 r.p.m. at 5,000 ft. (1,524 m.)	1,215 h.p. at 2,400 r.p.m. at 10,750 ft. (3,276 m.)	100/130
HERCULES 763 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,395 lb. (1,086 kg.)	2,080 h.p. at 2,900 r.p.m.	2,140 h.p. at 2,900 r.p.m. at 3,750 ft. (1,143 m.)	1,655 h.p. at 2,500 r.p.m. at 5,750 ft. (1,753 m.) and 1,535 h.p. at 2,500 r.p.m. at 16,500 ft. (5,031 m.)	1,220 h.p. at 2,400 r.p.m. at 12,500 ft. (3,810 m.) and 1,135 h.p. at 2,400 r.p.m. at 22,250 ft. (6,782 m.)	115/145
HERCULES 773 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,395 lb. (1,086 kg.)	2,125 h.p. at 2,900 r.p.m. with methanol water	2,150 h.p. at 2,900 r.p.m. at 1,500 ft. (457 m.) with methanol water	1,635 h.p. at 2,500 r.p.m. at 2,750 ft. (838 m.)	1,160 h.p. at 2,400 r.p.m. at 9,750 ft. (2,970 m.)	100/130
HERCULES 264 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,305 lb. (1,045 kg.)	1,950 h.p. at 2,800 r.p.m.	1,990 h.p. at 2,800 r.p.m. at 2,750 ft. (838 m.)	1,605 h.p. at 2,400 r.p.m. at 2,750 ft. (838 m.) and 1,535 h.p. at 2,400 r.p.m. at 11,000 ft. (3,353 m.)	1,125 h.p. at 2,400 r.p.m. at 11,750 ft. (3,582 m.) and 1,065 h.p. at 2,400 r.p.m. at 19,500 ft. (5,950 m.)	100/130
HERCULES 216 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,205 lb. (1,000 kg.)	1,800 h.p. at 2,800 r.p.m.	1,925 h.p. at 2,800 r.p.m. at 8,750 ft. (2,650 m.)	1,550 h.p. at 2,500 r.p.m. at 10,000 ft. (3,050 m.)	1,150 h.p. at 2,400 r.p.m. at 15,750 ft. (4,800 m.)	100/130
HERCULES 815 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,235 lb. (1,013 kg.)	2,300 h.p. at 2,900 r.p.m. with water methanol	2,310 h.p. at 2,900 r.p.m. at 500 ft. (153 m.) with water methanol	1,810 h.p. at 2,600 r.p.m. at 4,100 ft. (1,250 m.)	1,250 h.p. at 2,400 r.p.m. at 10,000 ft. (3,050 m.)	100/130

TYPE.—Fourteen-cylinder two-row air-cooled sleeve-valve radial with single-speed supercharger.

CYLINDER ASSEMBLY.—Bore 5¾in. (146 mm.). Stroke 6½ in. (165 mm.). Swept volume 2,360 cub. in. (38.7 litres). Open-ended light alloy barrels with deep closely-pitched fins, machined from solid. Cylinder heads have finned copper bases and steel bodies.

SLEEVE DRIVE.—By simple spur gear trains from the front end of the crankshaft, driving short cranks for the sleeves of the front bank and long cranks for the rear bank. Each sleeve crank is carried at one end in a self-aligning bearing in the crankcase, and at the other end in a plain bearing in the front cover, through which pressure oil is supplied for the sleeve ball assemblies. The cranks run at one-half engine speed and the intermediate gears are carried on needle roller-bearings.

PISTONS.—Fully-skirted type, with two wedge-section gas rings and a scraper ring above the gudgeon-pin and one bevelled scraper ring in the skirt. Gudgeon-pins fully-floating in pistons and small ends of connecting-rods.

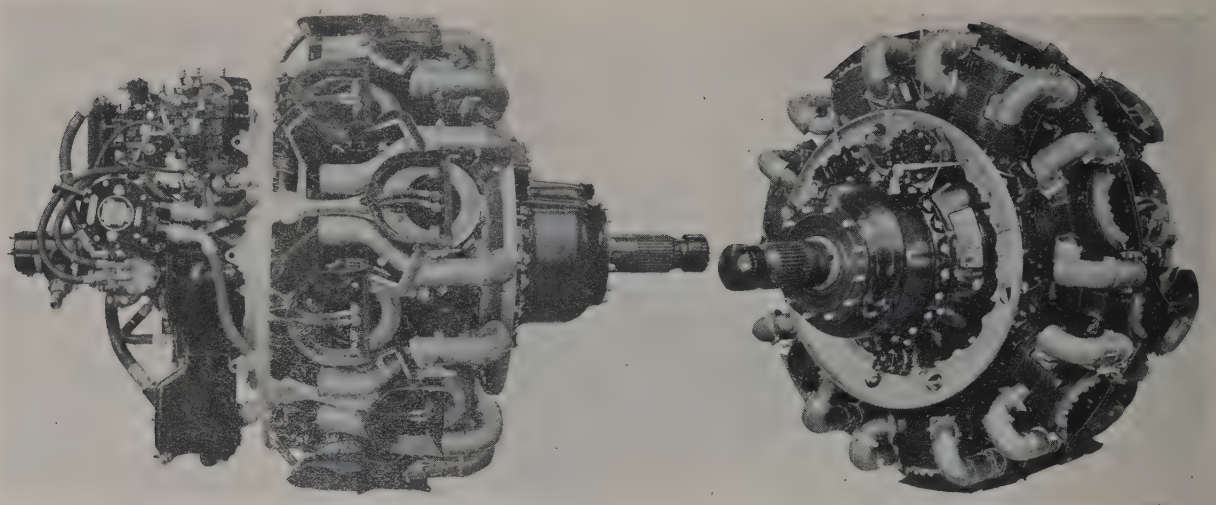
CONNECTING RODS.—Front and rear assemblies each comprising a master-rod, bearing directly on the white-metalled crankpin sleeve and six articulated rods carried in the master rod.

CRANKSHAFT.—Three-piece built-up type carried in four roller main bearings. Crankpins formed integral with centre section and fitted with white-metalled steel sleeves for big-end bearings.

CRANKCASE.—In three sections, carrying housings for the main bearings and sleeve crank bearings.

FRONT COVER.—Encloses the sleeve drive mechanism and has flanges and drives for the constant-speed unit and airscrew reversing pump. There is a small oil pump in the base of the casting to return surplus oil from the front of the engine to the sump.

SUPERCHARGER.—Single-speed supercharger with duplicate driving trains. Single down-



Two views of the 2,040 h.p. Bristol Hercules 758 sleeve-valve radial engine.

draught intake and double-shrouded aluminium-alloy impeller. Individual induction pipes with screwed joints to all cylinders.

Rear Cover.—Carries the essential engine accessories, magnetos, starter and fuel pump, and embodies a high-powered accessory drive (150 h.p. max.) for cabin superchargers, etc.

Fuel System.—A Hobson-R.A.E. injector is fitted as standard.

Ignition System.—Two magnetos supply separately two plugs per cylinder. Waterproof and fully-screened ignition harness.

Lubrication System.—Direct pressure lubrication from oil pump in the sump through hollow main driving shaft and crankshaft, to supercharger, big end bearings and reduction gear. Separate pressure lines deliver oil to sleeve driving mechanism. Pistons and sleeves splash lubricated and supplemented by oil jets in the crankshaft. Oil in sump returned to tank by scavenge pump which is integral with pressure pump.

Reduction Gear.—Epicyclic bevel type with a ratio of 0.44 : 1. The front and rear bevels are located by spherical seats, spreading the load evenly over the three bevel pinions. Rear bevel wheel is driven from the crankshaft through a toothed coupling. Large diameter internal oil passages and oil transfer system ensure rapid propeller reversing. Torquemeter built integral with the reduction gear.

Dimensions, Weight and Performance.—See Table.

CIRRUS

CIRRUS ENGINE DIVISION, BLACKBURN AND GENERAL AIRCRAFT LTD.

Head Office and Works: Engine Dept., Brough, E. Yorks.

London Office: 43, Berkeley Square, London W.1.

Directors: E. Turner, A.C.A. (Chairman and Managing Director), Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S., N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., Whit.Ex., F.R.Ae.S., Sir Maurice Bonham Carter, K.C.B., K.C.V.O., Air Vice-Marshal H. N. Thornton, C.B.E., Marshal of the Royal Air Force Sir John C. Slessor, G.C.B., D.S.O., M.C.; T. Bancroft and A. F. Jopling.

General Manager: J. B. Bucher, Dip.Ing., M.I.Mech.E., M.I.E.S., M.I.S.I.

Sales Manager: Group-Capt. H. J. Wilson, C.B.E., A.F.C.

The Cirrus aero-engine, the pioneer light four-cylinder in-line air-cooled engine, made possible the light aeroplane of to-day, and its long list of successes in light aircraft of many types dates back to 1925.

The final production versions were the Cirrus Major Series 3 and Cirrus Minor Series 2A, many of which remain in service and which have been described fully in previous editions of "All the World's Aircraft."

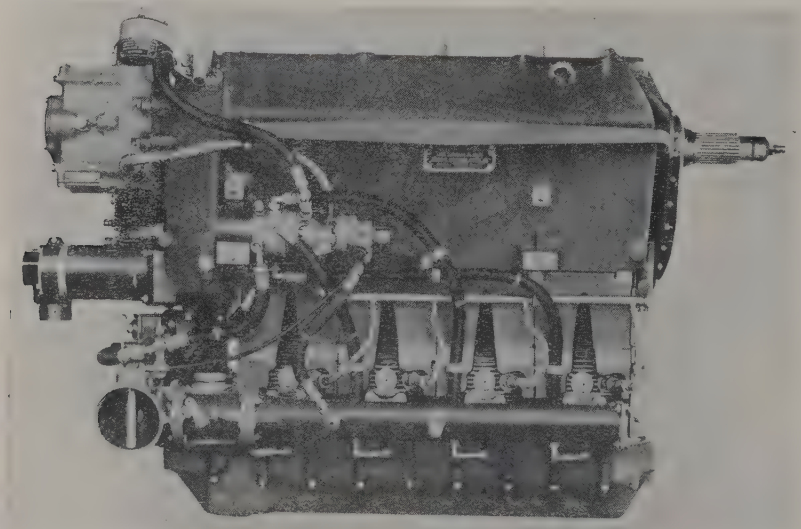
During post-war years the Cirrus Engine Division has been developing direct petrol injection engines and the first of these to be completed and to pass the British Air Registration Board approval tests is the Bombardier, which is in production for the Auster Mk. 9 aircraft and is described below.

The British manufacturing rights for Turbomeca gas-turbine engines were acquired in October, 1952. Details of these units will be found under "Blackburn-Turbomeca" in Part I of this Section.

THE CIRRUS BOMBARDIER 702.

The Bombardier is intended primarily for use with the Fairey Reed thin-boss fixed-pitch metal airscrew. If required an optional airscrew hub is available for use with a conventional thick-boss fixed-pitch airscrew, either metal or wood. The engine can also be adapted for the use of a constant-speed airscrew.

The engine is fitted with fuel-injection equipment and will be suitable for use with safety fuels when these become available. It is in production for the Auster Mk. 9 aircraft.



The 180 h.p. Cirrus Bombardier 702 engine.

Type.—Four-cylinder in-line inverted air-cooled. Direct drive L.H. tractor.

Cylinders.—Bore 4.8 in. (121.92 mm.). Stroke 5.5 in. (139.7 mm.). Capacity 398.12 cub. in. (6.524 litres). Compression ratio 7 : 1. High carbon steel barrels machined from solid, with Y-alloy pent-roof type head screwed on. Cylinders attached to crankcase by eight studs and nuts. Each cylinder head has fitted two sparking plug adapters, inlet and exhaust valve seat inserts and an adapter for a fuel injection nozzle.

Pistons.—Aluminium alloy slipper type. Two compression and one scraper ring. Fully floating gudgeon-pins located by end washers and circlips.

Connecting Rods.—H-section aluminium-alloy forgings with copper-lead steel-backed big-end bearings.

Crankshaft.—Fully machined high tensile steel forging balanced statically and dynamically, running in five copper-lead steel-backed main journal bearings. Thrust bearing combined with front main journal bearing. Two integral collars on front end of shaft to take thrust.

Crankcase Assembly.—Magnesium - zirconium alloy castings, comprising front cover, crankcase, top cover and rear cover. Crankcase houses lower halves of main journal bearings and thrust bearing. Top cover houses upper halves of bearings and also carries the front lifting eye integral with top cover. Rear cover houses rear gear train and has mounting faces for fitting auxiliaries and accessories. Rear lifting eye integral with rear cover.

Valve Gear.—One inlet and one exhaust valve per cylinder. Camshaft carried in carrier plate and driven by vertical shaft through bevel gears. Valve operating gear enclosed in cover which acts as oil bath for valve gear and sump from which oil is scavenged.

Ignition.—B.T.H. Duplex magneto. Fully-screened ignition harness.

Fuel System.—Two Amal type 240/48 engine-driven fuel pumps supply fuel to

S.U. injection pump driven from rear gear train. S.U. pump meters fuel through rigid injection pipes to fuel injection nozzles. Injection metering varied quantitatively with manifold pressure, air intake temperature and altitude by variation of pump stroke controlled by capsule and oil servo mechanism.

FUEL.—Gasoline, 91/98 Octane minimum.

LUBRICATION.—One pressure pump and duplex scavenge pump.

ACCESSORIES (Optional).—Plessey Type B3X Mk. 3 vacuum pump. Rotax type B1815 electric generator. Hymatic air compressor. Electric tachometer generator (unless C.S.U. is fitted). Constant speed unit. Mechanical tachometer.

AIRSCREW.—Standard, Fairey Reed Type 66960 thin-boss fixed-pitch metal airscrew. Optional, approved thick-boss fixed-pitch airscrews and approved constant-speed and variable-pitch airscrews.

STARTING.—Rotax 24-volt electric (direct-cranking).

COOLING.—Air scoop and cylinder baffles supplied with engine.

DIMENSIONS.—
Length overall 45.3 in. (1,152 mm.).
Height 30.95 in. (786 mm.).
Width 19 in. (483 mm.).

NET DRY WEIGHT.—
Including fuel pumps, screened ignition and airscrew hub but excluding bearer feet and exhaust system 379 lb. (172 kg.) + 2½%.

PERFORMANCE.—
Take-off 180 h.p. at 2,600 r.p.m. at sea level.
Max. continuous power rating 158 h.p. at 2,300 r.p.m. at 1,250 ft. (380 m.).
Max. weak mixture power 140 h.p. at 2,200 r.p.m. at 3,250 ft. (990 m.).

FUEL CONSUMPTIONS.—
Max. take-off (upper limit) 13.75 Imp. gallons (62.42 litres) per hour.
Max. continuous (upper limit) 10.75 Imp. gallons (48.80 litres) per hour.

OIL CONSUMPTION.—
At max. continuous rating 1.0 to 3.5 pints (0.57 to 1.98 litres) per hour.

COVENTRY VICTOR

THE COVENTRY VICTOR MOTOR COMPANY, LTD.

HEAD OFFICE AND WORKS: COVENTRY.

Directors: Major W. A. Weaver, M.Inst.B.E., F.I.M. (Managing); S. J. Cordery; G. R. Campion and W. Winters.

Long-famous as a manufacturer of horizontally-opposed piston-engines for industrial applications, the Coventry Victor Motor Company has now produced, at its own expense, a version of its Neptune four-cylinder engine expressly for use in light aircraft.

First tests of this engine, known as the Flying Neptune, were made in a Piper Cub airframe in 1955. No troubles were experienced in a 50-hour flight test programme and, after minor modifications, the engine was cleared for production.

THE COVENTRY VICTOR FLYING NEPTUNE.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 3.346 in. (85 mm.). Stroke 3.15 in. (80 mm.). Capacity 110.76 cub. in. (1,815 cc.). Compression ratio 6.5 : 1. Barrels cast in D.T.D. 424 aluminium alloy with pressed-in cast iron liners. Heat-treated cast aluminium alloy heads embody hemispherical combustion chambers with inclined hardened-steel valve inserts, and are each attached by four studs and nuts, passing through barrels and into crankcase.

PISTONS.—Aluminium pistons with two compression and one scraper rings, all above fully-floating hardened-steel gudgeon pins.

CONNECTING RODS.—High-tensile steel forgings with white metal steel-backed strip big-end bearings and bronze-bushed little-end bearings.

CRANKSHAFT.—One-piece low nickel-chrome content molybdenum steel forging to specification EN.110. Runs in three thin-wall main bearings with white metal steel-backed shells.

CRANKCASE.—Solution-treated Elektron C, with bolted-on sump of similar material.

VALVE GEAR.—Two inclined (inlet and exhaust) valves per cylinder of EN.59 austenitic steel. Valve seats are bichrome inserts, shrink-fitted in place. Camshaft, above and parallel to crankshaft, has silent chain drive.

INDUCTION SYSTEM.—Single Solex 40 WNH EO/2 carburettor mounted under sump. Single outlet bifurcates under centre of engine, each branch bifurcating again to intake ports.

IGNITION.—Two Lucas S.R. screened magnetos above engine, gear-driven from camshaft. Two Lodge Type C.B.14 sparkplugs per cylinder. Screened ignition harness.

LUBRICATION.—Wet-sump system, pressure-lubricating all main bearings and big ends. Gear-type oil pump. Easily detachable suction-type filter.

FUEL GRADE.—Standard premium grade, as obtainable from garages.

ACCESSORIES.—Tachometer driven from rear of camshaft by floating coupling.

STARTING.—By hand.

MOUNTING.—Two bearers, each with four ½ in. bolts.

DIMENSIONS.—
Width 30 in. (762 mm.).
Length 24.75 in. (629 mm.).
Height 22 in. (559 mm.).

WEIGHT (production form).—
210 lb. (95.25 kg.).

PERFORMANCE.—
Take-off power 55-60 h.p. at 3,200 r.p.m.
Continuous cruising power 44 h.p. at 2,600 r.p.m.

CONSUMPTIONS.—
Fuel at take-off power 0.53 pints (0.30 litres) per h.p./hr.
Oil approx. 0.125 pints (0.07 litres) per hr.

DE HAVILLAND

THE DE HAVILLAND ENGINE CO., LTD.

HEAD OFFICE: LEAVESDEN, HERTFORDSHIRE.

Directors: Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S. (President); A. F. Burke, O.B.E., M.Inst.T., F.R.S.A. (Chairman); H. Buckingham (General Manager); W. E. Nixon, F.C.I.S.; J. L. P. Brodie, M.I.A.E., M.I.Mech.E.; Dr. E. S. Moult, Ph.D., B.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S.; and M. G. Ash.

The de Havilland Engine Co. Ltd. was formed in February, 1944, from the Engine Division of the de Havilland Aircraft Co., Ltd., and is now one of the three main operating subsidiaries in Great Britain of de Havilland Holdings, Ltd. In addition to its range of gas-turbine engines, the company continues to manufacture the well-known Gipsy four and six-cylinder air-cooled piston engines.

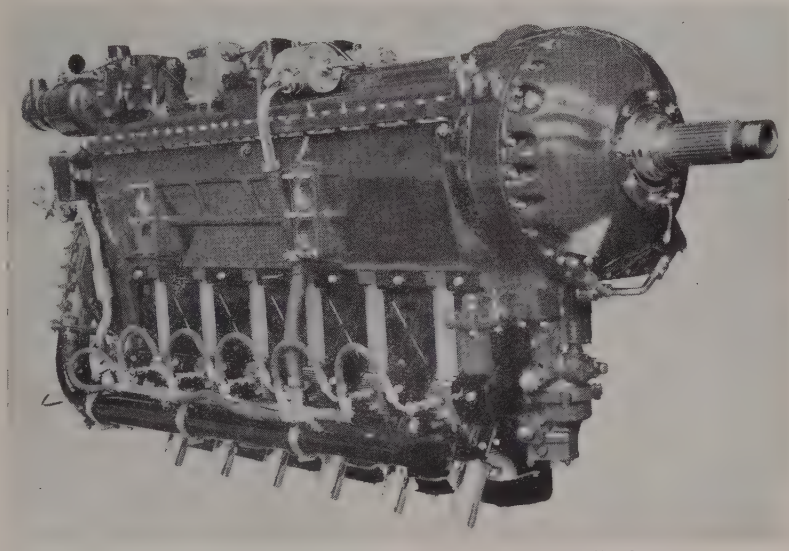
The current range of Gipsy engines included the 250 h.p. direct-drive normally-aspirated Gipsy Queen Series 30; the 340 h.p. and 380 h.p. (Mk. 2) geared and supercharged Gipsy Queen Series 70, both six-cylinder engines; and the 145 h.p. Gipsy Major 10, 200 h.p. Gipsy Major 200 and 215 h.p. Gipsy Major 215 four-cylinder engines.

The Gipsy Queen Series 70 is the power unit of the D.H. Dove twin-engined light transport and is also fitted to the Short Sealand amphibian and the Handley Page Marathon. The Gipsy Queen 30 Mark 2 is the power-plant of the de Havilland Heron four-engined feeder liner.

The Gipsy Major 10 is an improved and refined post-war version of the Gipsy Major I.

The Gipsy Major 200 makes use of the Gipsy Queen 30/70 Series cylinder heads and barrels, has S.U. fuel injection and an entirely new crankcase and accessory layout. It is suitable for both fixed or rotary wing application.

Latest engine in the four-cylinder series is the Gipsy Major 215, which is a development of the Gipsy Major 200 and is used in the Saunders-Roe Skeeter helicopter.



The 380 h.p. de Havilland Gipsy Queen Series 70 Mk. 2 engine.

Details of de Havilland gas-turbine engines will be found in Part I of this Section.

THE D.H. GIPSY QUEEN SERIES.

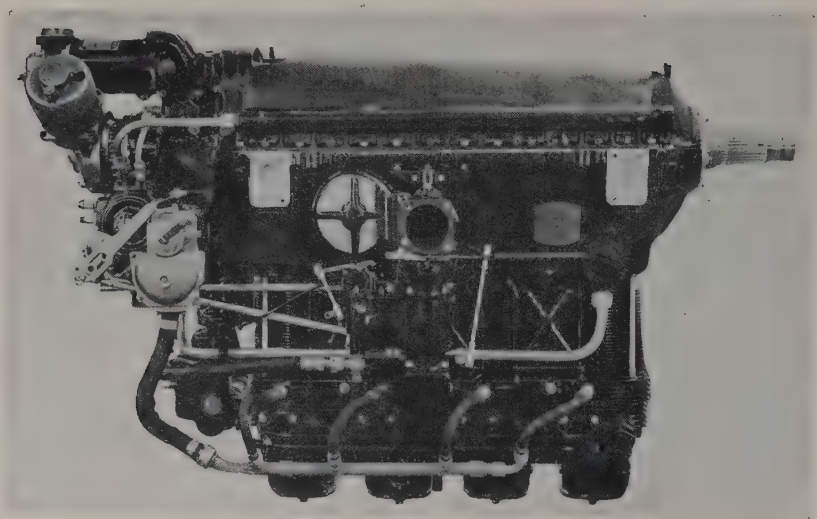
TYPE.—Six-cylinder in-line inverted air-cooled direct-drive (Series 30) or geared and supercharged (Series 70).

CYLINDERS.—Bore 4.725 in. (120 mm.). Stroke 5.905 in. (150 mm.). Swept volume 622 cub. in. (10.178 litres). Compression ratio 6.5 : 1. Barrels machined all over from carbon steel forgings. Working portion of bore hard-chromed. Barrel spigots into crankcase and aluminium-alloy head clamped to barrel and crankcase by four long steel studs. Moulded Dermatine or Neoprene ring between cylinder and crankcase and plain copper washer between barrel and head.

PISTONS.—Fully-skirted, machined from light alloy forgings with two compression and one scraper rings. Fully floating gudgeon-pin located by external circlips and washers.

CONNECTING RODS.—I-section nickel-chrome steel forgings. Split big-ends with thin-wall linings. Small-ends have lead-bronze bushes.

CRANKSHAFT.—Six-throw shaft is a nickel-chrome forging machined all over and statically and dynamically balanced. Shaft runs on eight plain main bearings in case of Queen 30 and seven in case of Queen 70. Bearings of normal split type lined with thin-wall shells which consist of a steel strip backing lined with lead-bronze on which a thin skin of lead is deposited. A fine wall of indium is infused into bearing



The 145 h.p. de Havilland Gipsy Major 10 Mk. 2 engine.

surface. In case of Series 70 an epicyclic reduction gear is driven off crankshaft through non-lined spring coupling. Gear ratio 0.711 : 1. Propeller shaft is supported at the rear by two plain white-metalled bearings and at the front by single-row ball-bearing transmitting thrust in either direction through reduction-gear casing.

CRANKCASE (Series 70).—Aluminium-alloy main case stiffened by cross webs which carry the main and camshaft bearings, and additionally strengthened by two cross bolts, passing through the upper part of web and bearing cap of Nos. 1 and 4 main bearings. Rear wall extends below level of cylinder mounting face to form sump. Top cover is magnesium-alloy casting and carries magnetos, distributors, vacuum pump, generator, air compressor (hydraulic pump alternative) and their drives.

CRANKCASE (Series 30). —Basically similar to that of Queen 70, main differences being that it is in magnesium-alloy, that a cross shaft bolt is only fitted at No. 4 main bearing and that rear of crankcase is closed by rear cover.

VALVE GEAR.—Fully enclosed, one inlet and one exhaust valve to each cylinder. Operation by steel rockers, tubular aluminium-alloy push-rods and steel tappets of hollow steel camshaft running in plain bearings in port side of crankcase. Camshaft driven by spur gears from front end of crankshaft. Both inlet and exhaust valve stems tipped with Stellite and head of exhaust valve and valve seat coated with C.26. Sodium-cooled exhaust valves.

INDUCTION (Series 30).—Pair of single-choke Hobson type A.I.55E/1 downdraught carburettors, each feeding three cylinders through separate three-branch manifolds. Air intake incorporates hot and cold air intake shutter and flame-trap.

INDUCTION (Series 70).—Hobson type DHG/1 fuel-injection unit metering fuel through injection nozzle into eye of supercharger impeller.

SUPERCHARGER (Series 70). Centrifugal type driven through two gear trains and a spring quillshaft which is co-axial with and passes through hollow camshaft. Gear Ratio 11.22 : 1.

IGNITION.—Two screened B.T.H. type CGD magnetos and B.T.H. distributors mounted on crankcase top cover and gear-driven from an auxiliary drive shaft at $1\frac{1}{2}$ and $\frac{1}{2}$ times engine speed respectively. Two sparking plugs per cylinder. Fixed ignition.

LUBRICATION.—Dry sump system, one pressure and two scavenge pumps with fabric-type pressure filter. Gauze filters on suction side for all three pumps. Main bearings, big end and most bearings fed with oil under pressure. Pistons and cylinder walls sprayed with oil by jets from big-ends supplemented by oil mist; other moving parts by oil mist or splash. Valves and rocker gear operate in oil baths. Provision for Worth oil dilution system.

ACCESSORIES.—All accessories driven off rear of auxiliary drive shaft, each accessory coupled to its driving gear by splined coupling sleeve. Electric starter complete with hand turning gear or feathering pump is provided. Accessories include vacuum pump, generator up to 1,500 watts and provision can be made for compressor or hydraulic pump.

COOLING.—Scoops are fitted to the port side of the engine. Air collected by these scoops is passed between the cylinders and heads and suitably deflected by special baffles on starboard side of engine.

AIRSCREW (Queen 70).—Either (*a*) de Havilland bracket constant-speed type airscrew or (*b*) de Havilland hydromatic constant-speed feathering and braking airscrew, or other approved constant-speed airscrew.

AIRSCREW (Queen 30).—(*a*) or (*b*) as above. In addition (*c*) any approved type of fixed-pitch airscrew, either metal or wood.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE DE HAVILLAND GIPSY MAJOR 10 Mk. 2.

TYPE.—Four-cylinder in-line inverted air-cooled, direct-drive.

CYLINDERS.—Bore 4.646 in. (118 mm.). Stroke 5.512 in. (140 mm.). Swept volume 373.6 cub. in. (6.124 litres). Compression ratio 6 : 1. Barrels machined all over from forgings of carbon steel. Detachable heads of aluminium-alloy held by long H.T. steel studs to crankcase. Copper-asbestos gasket between cylinder barrel and head to ensure gastight joint.

PISTONS.—Slipper type machined from aluminium-alloy forgings. Fully-floating gudgeon-pin located by external circlips and washers. One scraper and two compression rings below gudgeon-pin.

CONNECTING RODS.—Machined all over from light-alloy stampings with split big-ends clamped together by four bolts and nuts. Big-end bearing of steel-backed white-metal-lined type. Small-end bearings unbushed.

CRANKSHAFT.—Machined all over from nickel-chromium-alloy steel forgings. Statically and dynamically balanced. Five steel-backed thin-wall Vandervell type main bearings. Ball-bearing to take thrust at front end. Journals and pins bored for lightness and lubrication.

CRANKCASE.—Aluminium-alloy casting. Lower half carries the five main crankshaft bearings, which are held in position by separate caps. Top cover is of magnesium-alloy stoutly ribbed to resist deflection.

VALVE GEAR.—Fully enclosed. One inlet and one exhaust valve to each cylinder. Sodium-cooled exhaust valves are used in the Series 10 Mk. 2 and Series 8. Operation by steel rockers, tubular steel push-rods, and steel tappets off camshaft running in five bearings on port side of engine. The camshaft is driven by spur-gears from rear end of crankshaft.

INDUCTION.—Claudel-Hobson AI.48 downdraught carburettor. Two position independent control change-over flap enables warm air to be selected by pilot under icing conditions. Altitude control is provided by an air valve in carburettor, operated from cockpit. Twin D.H. A.C. fuel pumps complete with hand-priming levers and remote controls for carburettor flooder fitted to port side of the crankcase and driven by cams from camshaft.

IGNITION.—Two B.T.H. magnetos mounted in inverted position on either side of rear cover. Impulse starter coupling on starboard magneto. Ignition equipment can be supplied screened or unscreened as required.

LUBRICATION.—Dry sump system. Engine-driven gear-type pump delivers at a pressure of 40 to 45 lb. per sq. in. (2.81 to 3.16 kg./cm.^{2}) to an Auto Klean filter. Crankshaft, connecting-rods, camshaft and timing gear are pressure-fed from the main oilway. Cylinders lubricated by splash from connecting rod big-ends. Secondary external oil pipe lubricates all accessory drives and bearings on rear cover above crankshaft gear. Remaining gears and bearings in lower part of cover lubricated by splash oil from magneto gears and leakage past idler gear bushes which receive pressure oil from rear main bearings. Valve rocker gear lubricated separately by splash from rocker covers which are filled with oil to prescribed level.

ACCESSORIES.—The following accessories are driven from rear of crankshaft:—Vacuum pump, generator up to 500 watts, and there is provision for an electric or cartridge starter driving through a 12-jaw dog.

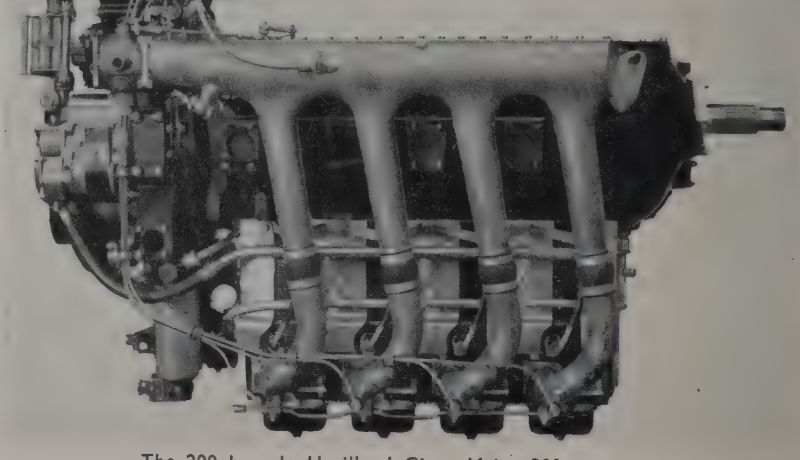
COOLING.—Same as for Gipsy Queen.

AIRSCREW DRIVE.— Direct. Left-hand tractor. Provision for fixed-pitch wood or metal airscrew of approved design or manually-operated variable-pitch airscrew, on No. 1 SBAC parallel-splined shaft.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE DE HAVILLAND GIPSY MAJOR 200.

The Gipsy Major 200, which is suitable for both fixed and rotary wing application, makes use of Gipsy Queen 30/70 Series cylinder heads and barrels, has an entirely new crankcase and accessory layout, and is fitted with S.U. fuel injection.



The 200 h.p. de Havilland Gipsy Major 200 engine.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 4.725 in. (120 mm.). Stroke 5.905 in. (150 mm.). Swept volume 416 cub. in (6.79 litres). Compression ratio 7.25 : 1. Barrels machined all over from carbon steel forgings. Working portion of bore hard chromed. Barrel spigots into crankcase and aluminium head clamped to barrel and crankcase by four long steel studs.

PISTONS.—Fully-skirted type of light alloy. Three rings, two compression and one scraper. Plain gudgeon-pins retained by circlips and washers.

CONNECTING RODS.—Machined all over from steel forgings. Big-end bearings of thin-wall lead-bronze type. Small-ends are phosphor-bronze-bushed.

CRANKSHAFT.—Machined all over from nickel-chrome steel forging. Steel-nitrided. Five thin-wall steel-backed lead-bronze-lined bearings.

CRANKCASE.—Magnesium-alloy, stiffened by cross-webs and cross-bolted.

VALVE GEAR.—Fully-enclosed. One inlet and one exhaust valve per cylinder. Exhaust valves sodium-cooled. Inlet valve seats peened, exhaust valve seats screwed into cylinder heads. Camshaft in lower port side of crankcase driven from crankshaft through compound idler gear.

INDUCTION.—S.U. direct fuel injection into inlet ports.

IGNITION.—Two B.T.H. Type SG4 magnetos, with impulse starter on each, mounted on wheelcase. Two K.L.G. KA1 or RC5/4H sparking-plugs per cylinder. Tecalemit ignition harness.

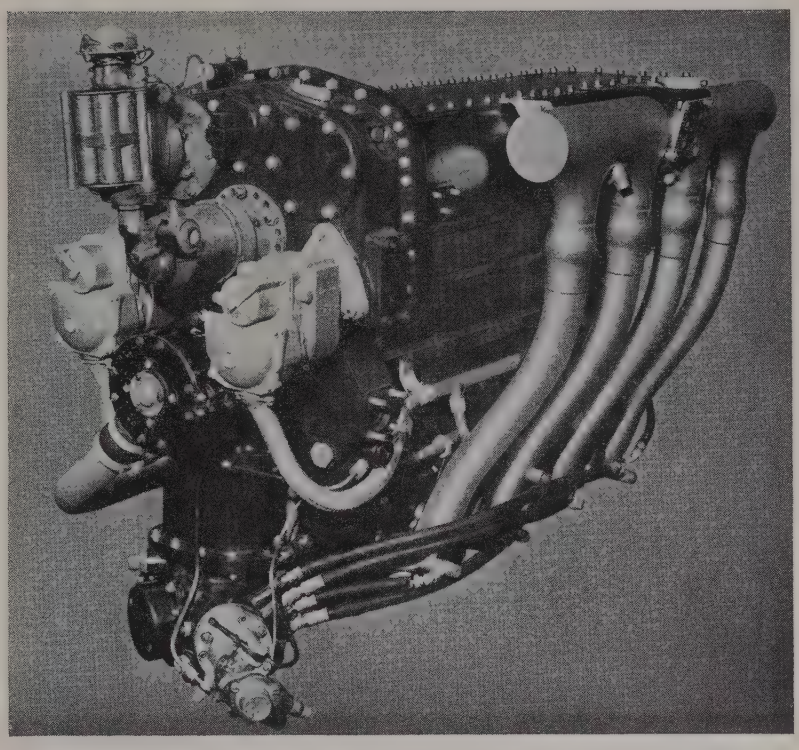
LUBRICATION.—Dry sump system. One pressure, two scavenge pumps.

AIRSCREW DRIVE OR DRIVE FOR HELICOPTER PRIMARY GEAR-BOX.—Direct. Direction counter clockwise seen from rear. S.B.A.C. No. 1 airscrew shaft.

ACCESSORIES.—Engine accessories include S.U. fuel injector pump (1 : 1 gear ratio). Plessey F.1 Mk. 3M fuel pump (0.75 : 1 gear ratio), and Smiths 122-RV/SP engine speed indicator and generator (1 : 1 gear ratio). Aircraft accessories include Hymatic SH6/7C air compressor or, alternatively, Lockheed hydraulic pump (gear ratio 0.548 : 1), Plessey B. 3X/Mk. 2 vacuum pump (1.27 : 1 gear ratio), and Rotax B.2001-2F generator (2.55 : 1 gear ratio).

STARTING.—Plessey S3 Mk. 3 cartridge (helicopter and fixed-wing installation) or B.T.H. electric (fixed-wing).

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.



The 215 h.p. de Havilland Gipsy Major 215 engine.

THE DE HAVILLAND GIPSY QUEEN AND GIPSY MAJOR ENGINES.

Engine Type	Gipsy Queen 30 Mk. 2	Gipsy Queen 70-4	Gipsy Queen 70 Mk. 2	Gipsy Major 10 Mk. 2	Gipsy Major 200	Gipsy Major 215
Take-off Power	240-250 h.p. at 2,500 r.p.m. at sea level Fuel consumption 18.75-19.5 gals. (85.1-88.5 litres) per hr.	325-340 h.p. at 2,800 r.p.m. at sea level Fuel consumption 32.75 gals. (147.3 litres) per hr.	365-380 h.p. at 3,000 r.p.m. at sea level Fuel consumption 36.5-38 gals. (161.3-168 litres) per hr.	139-145 h.p. at 2,550 r.p.m. at sea level Fuel consumption 11.0-11.5 gals. (50-52.2 litres) per hr.	192-200 h.p. at 2,600 r.p.m. at sea level Fuel consumption 14.4-15 gals. (65.4-86.2 litres) per hr.	215 h.p. at 2,850 r.p.m. at sea level
Maximum Continuous Power	240-250 h.p. at 2,500 r.p.m. at sea level Fuel consumption 18.75-19.5 gals. (84.3-87.7 litres) per hr.	316-330 h.p. at 2,600 r.p.m. at 5,000 ft. (1,525 m.) Fuel consumption 23.5-24.5 gals. (106.7-111.2 litres) per hr.	341-355 h.p. at 2,700 r.p.m. at 4,250 ft. (1,296 m.) Fuel consumption 31.6-32.9 gals. (142.2-148 litres) per hr.	136-142 h.p. at 2,400 r.p.m. at sea level Fuel consumption 10.75-11.25 gals. (48.3-50.6 litres) per hr.	186-194 h.p. at 2,500 r.p.m. at sea level Fuel consumption 13.9-14.4 gals. (63.2-65.6 litres) per hr.	N.A.
Maximum Weak Mixture Power	206 h.p. at 2,500 r.p.m. at 2,900 ft. (884 m.) Fuel consumption 12.3-12.9 gals. (55.9-58.5 litres) per hr.	265 h.p. at 2,400 r.p.m. at 8,000 ft. (2,440 m.) Fuel consumption 17.5 gals. (79.5 litres) per hr.	265 h.p. at 2,400 r.p.m. at 8,000 ft. (2,440 m.) Fuel consumption 16.8-17.5 gals. (75.6-78.7 litres) per hr.	125 h.p. at 2,300 r.p.m. at 3,000 ft. (915 m.) Fuel consumption 8.85-9.0 gals. (39.8-40.5 litres) per hr.	160-167 h.p. at 2,500 r.p.m. at sea level Fuel consumption 9.2-9.6 gals. (41.6-43.5 litres) per hr.	N.A.
Weight dry (including cooling scoops, baffles and fuel-pump unit)	525 lb. (238.3 kg.) + 2½%	685 lb. (311 kg.) + 2½%	690 lb. (313 kg.) + 2½%	325 lb. (147.5 kg.) + 2½%	400 lb. ±5 lb. (181.4 kg. ±2.3 kg.)	400 lb. ±5 lb. (181.4 kg. ±2.3 kg)
Supercharger gear ratio	—	11.22 : 1	11.22 : 1	—	—	N.A.
Airscrew gear ratio	—	0.811 : 1	0.711 : 1	—	—	—
Overall length (from centre-line of airscrew)	61.5 in. (1,562 mm.)	71.75 in. (1,822 mm.)	71.75 in. (1,822 mm.)	42.1 in. (1,070 mm.)	51 in. (1,295 mm.)	51 in. (1,295 mm.)
Overall width	19.59 in. (497.5 mm.)	19.56 in. (497 mm.)	19.56 in. (497 mm.)	20.1 in. (510 mm.)	16.8 in. (426 mm.)	16.8 in. (426 mm.)
Overall height	32.99 in. (838 mm.)	33.23 in. (844 mm.)	33.23 in. (844 mm.)	30.6 in. (777 mm.)	29.8 in. (758.5 mm.)	29.8 in. (758.5 mm.)
Fuel Grade	Min. Octane 91-96	Min. Octane 100-130	Min. Octane 100-130	Min. Octane 80	Min. Octane 100-130	Min. Octane 100-130

THE DE HAVILLAND GIPSY MAJOR 215.

Developed from the Gipsy Major 200, this engine incorporates a number of refinements and will be available in due course with an exhaust-driven turbo-supercharger which will enable the full-throttle power of 215 h.p. to be maintained up to 4,000 ft. (1,220 m.) and ICAN + 30°C. Until this supercharger is ready for installation, water-methanol injection equipment is being fitted as a temporary measure. A governer control is fitted to limit the maximum r.p.m. when the engine is running with the main rotor de-clutched to avoid the possibility of an engine over-speed.

The Gipsy Major 215 powers the Saunders-Roe Skeeter light helicopter, under the military designation of Gipsy Major Mk. 140.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—As for Gipsy Major 200, except that the aluminium-alloy head is secured to the barrel by eight studs located in the head, and the barrel secured to the crankcase by a base flange and eight short studs located in the crankcase lower face.

PISTONS, CONNECTING RODS and CRANKSHAFT.—As for Gipsy Major 200.

CRANKCASE.—As for Gipsy Major 200. Top cover plate in aluminium-alloy, acid-etched for lightness.

VALVE GEAR.—One "tulip" pattern high-chromium steel inlet valve and one hollow, sodium-cooled, stellite-tipped exhaust valve per cylinder. Firth NMC valve seats. Inlet valve seats peened, exhaust valve seats screwed into cylinder heads. Camshaft as for Gipsy Major 200.

INDUCTION.—S.U. direct fuel injection into ports. Pump at bottom of main wheelcase, drive being taken through oil pump.

SUPERCHARGER (when fitted).—Exhaust-driven turbo-supercharger.

IGNITION, LUBRICATION AND AIRSCREW DRIVE.—As for Gipsy Major 200.

ACCESSORIES.—As for Gipsy Major 200, except that fuel pump is Plessey F.1 Mk. 14. Methanol-water injection optional.

STARTING.—As for Gipsy Major 200.

MOUNTING.—Four bearer pads, one at each corner of crankcase.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

ROLLS-ROYCE

ROLLS-ROYCE, LTD.

HEAD OFFICE: DERBY.

WORKS: DERBY, GLASGOW AND EAST KILBRIDE.

LONDON OFFICE: 14-15, CONDUIT STREET, W.1.

Established: March 15, 1906.

Directors: Lord Kindersley, C.B.E., M.C. (Chairman); J. D. Pearson, B.Sc. (Eng.), Wh.Sc., M.I.Mech.E., A.F.R.Ae.S., M.I.P.E. (Deputy Chairman and Chief Executive, Aero-Engine Division); Whitney W. Straight, C.B.E., M.C., D.F.C. (Deputy Chairman); Harald Peake, M.A.; W. T. Gill, C.A.; Dr. F. Llewellyn Smith, M.Sc., D.Phil (Managing Director, Motor Car Division); W. A. Robotham (Managing Director, Oil Engine Division); A. A. Rubbra; A. F. Kelley.

Chief Engineer, Aero Engine Division: A. A. Lombard, F.R.Ae.S.

Delivery of the last new Rolls-Royce aircraft piston-engine, a Griffon for an Avro Shackleton of the South African Air Force, was made from the company's Derby works in December, 1955.

Rolls-Royce began aero-engine production in December, 1915, and built a total of 51,169 piston-engines at Derby alone in the following 40 years. A still larger number was built in the company's other factories.

Rolls-Royce piston-engines included many famous types, notably the Falcon and Eagle of the 1914-18 war; the Kestrel of the inter-war period; and the ubiquitous and versatile Merlin and the Griffon of the 1939-45 war.

Many great flights were made on Rolls-Royce piston-engines, including the first non-stop Atlantic crossing by Alcock and Brown in the Eagle-powered Vimy, the first flights from England to Australia, to India and to South Africa, and the first crossing of the South Atlantic by an Eagle-engined Fairey IIID seaplane. Specially developed Rolls-Royce "R" racing engines, boosted eventually to give the then-unprecedented power of 2,300 h.p., enabled Supermarine seaplanes to win the 1929 and 1931 contests for the Schneider Trophy, gaining the Trophy outright for Britain. The "R" provided invaluable experience for development of the later Merlin and Griffon.

More Merlin engines were built than any other type of British aero-engine, with wartime production by Packard in the United States supplementing home production. Very large numbers of Merlins and Griffons are still in civil and military service throughout the world, and Rolls-Royce will continue to manufacture spare parts for these and to undertake a certain amount of re-conditioning work.

Otherwise, Rolls-Royce aero-engine production capacity is now devoted exclusively to gas-turbines, and the company's current activities are described fully in the "Gas-turbines" Section of this work.

CZECHOSLOVAKIA

CESKOSLOVENSKÉ ZÁVODY AUTOMOBILOVÉ A LETECKÉ, (Czechoslovak Automobile and Aircraft Works).

HEAD OFFICE: PALACKÉHO NÁM 4, PRAGUE II.

Manager: Ladislav Hlavsa.

In this concern is grouped all the aviation industry, including the factories producing aero-engines and airscrews.

The sale of all the aviation products as well as the information service are handled exclusively by :—

OMNIPOL LTD., WASHINGTONOVA 11, PRAGUE III.

THE WALTER MINOR 4-III.

TYPE.—Four-cylinder inverted in-line air-cooled, ungeared.

CYLINDERS.—Bore 105 mm. (4.13 in.). Stroke 115 mm. (4.53 in.). Total capacity 3.98 litres (247.87 cub. in.). Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder and head assembly attached to crankcase by four cylinder holding-down studs.

PISTONS.—Aluminium-alloy stampings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring-circlips.

VALVE GEAR.—One inlet and one exhaust valve per cylinder, of special heat-resisting alloy steel with nitrided stems. Double valve springs. Valves operated by the camshaft through push-rods and rocker-arms. Rockers fitted with needle bearings, with rollers for the valves and valve-clearance adjusting-screws at the push-rod ends. Valve and rocker mechanism on each cylinder enclosed in Elektron cover.

CONNECTING RODS.—H-section, stamped from aluminium-alloy, polished. Split big-ends provided with steel-backed lead-bronze bearings.

CRANKSHAFT.—Forged from special chrome-vanadium steel, machined all over. Crank-pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

CRANKCASE.—Heat-treated magnesium-alloy casting.

LUBRICATION.—Dry-sump pressure lubrication. Double gear-type oil-pump with pressure and scavenge stages located at the rear of the crankcase above the sump. Oil drawn from oil tank by pressure pump, provided with an inlet and a pressure relief valve. Spent oil in sump withdrawn by scavenge pump and returned to oil tank. Union in the pressure line on the crankcase is adapted for pressure-gauge connection. The valve-gear works in an oil bath in each rocker cover box. The lubrication system can be modified on request for aerobatic flying, mainly by the addition of an automatic valve to the scavenge line.

INDUCTION SYSTEM.—Walter 45-I or 45-AK (aerobatic) down-draught carburettor with manual mixture control, acceleration pump, special jet for inverted flight and choke. Cast induction manifold, pre-heated by exhaust gases, fitted with four priming jets and with 4 drain valves. A hot and cold air intake controllable from the cockpit, fitted on special request. Cold air passes directly to the carburettor, warm air is drawn from the cylinders through a flame trap. Fuel supplied to the carburettor by double diaphragm Walter 2M 50 fuel-pump fitted with a pressure-gauge connection.

IGNITION.—Dual shielded ignition; non-shielded ignition optional. Two Scintilla Vertex magnetos OAF 4R 402 Z170 (port) and OAF 4R 602 Z170 (starboard) with automatic sparking advance. Magnetos placed side-by-side in a hanging position at the rear of the crankcase. Starboard magneto provided with impulse unit. Sparking plugs 12×1.25 mm. (PAL 12R 250).

COOLING.—Air scoop with an easily removable sliding inspection strip for access to the sparking plugs fitted on port side, with cylinder baffles on starboard side.

STARTING.—Electric and hand starter with crank, type Walter RE 25, or electric starter Walter P320, both supplied on request.

ACCESSORY DRIVES AND EQUIPMENT.—On the rear end of the crankcase; left-hand a tachometer drive (D. of R. clockwise, 1/2 engine speed); right-hand a fuel-pump mounting-flange and drive (D. of R. clockwise, 1/2 engine speed). On the port side of the crankcase can be fitted either a directly-driven 24-volt 300 watt. or 24-volt 600 watt. generator.

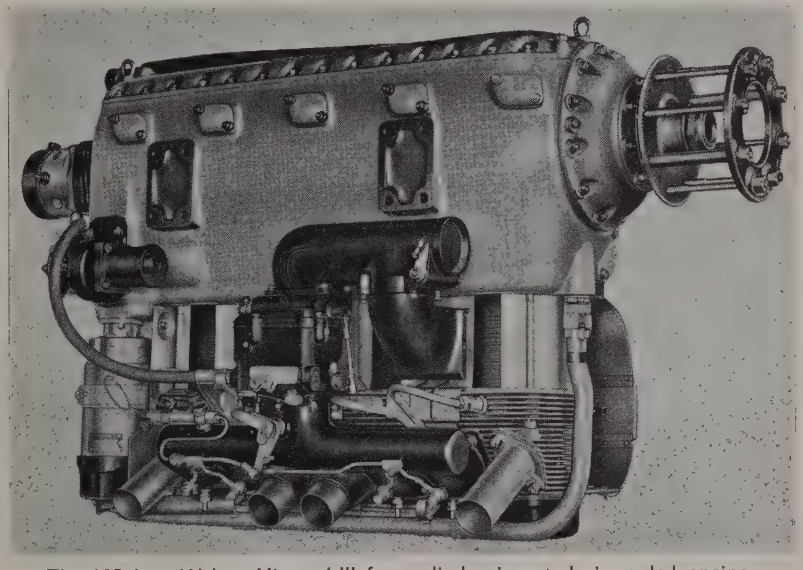
MOUNTING.—Four engine bearer feet with rubber vibration dampers, supplied on special request.

AIRSCREW DRIVE.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for wooden fixed-pitch airscrew is normally used. Keyed to the tapered crankshaft front-end and retained by a nut. Airscrew hub attached to boss by retaining plate and eight retaining bolts. VP-airscrew Walter V401 mechanically operated or Walter V401E electrically operated, both optional.

DIMENSIONS.—
Overall length with airscrew boss 1,032 mm. (40.63 in.).
Overall width without bearer feet 399 mm. (15.7 in.).
Overall height 632 mm. (24.9 in.).

WEIGHT DRY (including normal accessories).—90.3 kg. (199 lb.).

PERFORMANCE.—
Rated output at sea level 105 b.h.p. at 2,500 r.p.m.
Cruising output 80 b.h.p. at 2,300 r.p.m.



The 105 h.p. Walter Minor 4-III four-cylinder inverted air-cooled engine.

CONSUMPTIONS.—
Fuel consumption at rated sea level power 245 gr. (.54 lb.) per h.p./hr.
Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
Oil consumption 2-8 gr. (.0044-.018 lb.) per h.p./hr.

THE WALTER MINOR Sc. (M 332).

TYPE.—Four-cylinder inverted in-line air-cooled, ungeared, supercharged.

CYLINDERS.—Basically similar to those of Minor 4-III. Compression ratio 6.3 : 1. Valve seats of special steel. Valve guides and sparking plug bushes of bronze.

PISTONS.—Aluminium-alloy stampings with graphited surfaces. Two compression rings and one split scraper ring. Gudgeon pin secured by spring-circlips.

CONNECTING RODS—H-section aluminium-alloy forgings. Two split big-ends bolted together by two bolts. Steel two-piece liner lead-bronze plated.

CRANKSHAFT.—Forged from special chrome-vanadium steel, machined all over. Nitrided crank-pins. Carried in five steel-backed lead-bronze plated slide bearings which are lightly lead-lined, and in one ball-thrust bearing at the front. Terminating in a wedge-shape cone for the propeller hub mounting.

CRANKCASE.—Heat-treated magnesium alloy (elekton) casting, with top and front covers. Deep-sunk bearing covers forged from aluminium alloy.

VALVE GEAR.—Camshaft on the cylinder heads actuates the valves by means of rocker arms. Camshaft driven by vertical shaft and bevel gears. One inlet valve of heat-treated steel, one exhaust valve of austenitic steel with stellite seat. Nitrided valve stems.

IGNITION.—Shielded type. Two Scintilla-Vertex Type OBF 4R magnetos with automatic sparking advance. Magnetos placed vertically, driven by bevel gears provided with gear moment dampers. Two Jiskra 11/51A sparking plugs per cylinder 12×1.25 mm. (0.5×.07 in.).

LUBRICATION.—Dry sump pressure-feed type. Double gear-type oil-pump with pressure and scavenge stages mounted on rear wall of crankcase. Oil from tank passes through triple filter into pressure stage of oil-pump and then into main channel drilled in crankcase. Pressure control valve adjusted to 3.5-4 atm. Inlet union of main channel provided with oil-pressure gauge connecting pipe. Oil returned from sump by scavenge stage of oil-pump to tank. Special gear-type oil-pump draws oil from cam box and forces it into crankcase from where it flows into sump.

SUPERCHARGER.—Centrifugal type mounted on engine rear flange. Driven through a damping rubber coupling from crankshaft. Planetary gear, ratio 7.4 : 1, engaged via band friction clutch. Force feed lubrication of supercharger from main engine lubrication system.

FUEL SYSTEM.—Low-pressure injection system. Fuel pump driven from camshaft. Fuel injection nozzles located in front of intake valves. Automatic control in relation to engine manifold pressure. Fuel supplied to injection pump by fuel pressure pump located in common body with injection pump.

FUEL GRADE.—Minimum 72 octane.

COOLING.—Air scoop on port side, designed to provide easy access to sparking plugs and easy removal of scoop and baffles.

STARTING.—Electric starter combined with supercharger. Electric motor rotates the starter dog which is engaged by an electro-magnet. Gears and clutch of supercharger serve the starter also.

ACCESSORIES.—One 300 or 600 watt 24v. dynamo. Electric r.p.m. transmitter, drive 1 : 1. Airscrew control unit. Mechanical tachometer on oil pump, drive 1 : 2.

MOUNTING.—Four engine-bearer feet with rubber dampers.

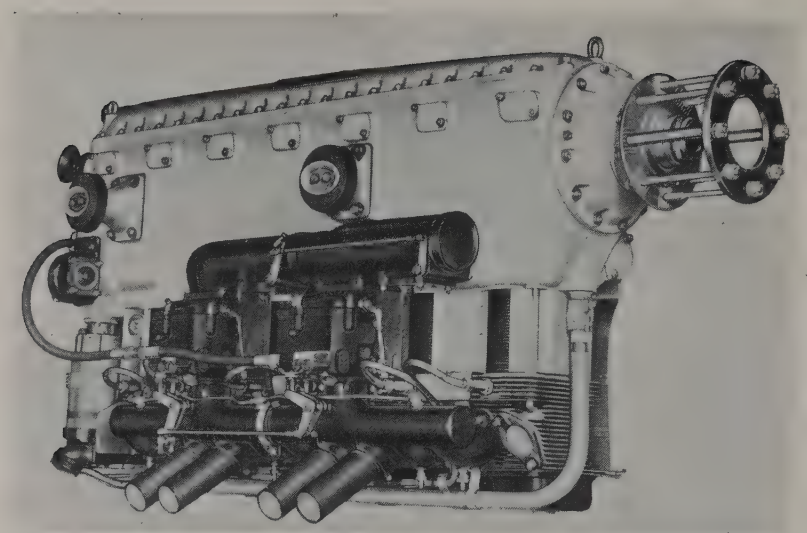
AIRSCREW DRIVE.—Direct left-hand tractor.

DIMENSIONS.—
Length (including supercharger and starter, but less propeller boss) 1,102 mm. (43.4 in.).
Height 628 mm. (24.7 in.).
Width (with dynamo and electric tachometer) 425 mm. (16.7 in.).

WEIGHTS.—
Dry (with ignition harness, supercharger and starter) 102 kg. (225 lb.).

PERFORMANCE.—
Take-off power 140 h.p. at 2,700 r.p.m.
Rated power 115 h.p. at 2,550 r.p.m.
Cruising power 100 h.p. at 2,400 r.p.m.

CONSUMPTIONS.—
Fuel at take-off power 0.26 kg. (0.57 lb.) per h.p./hr.
Fuel at rated power 0.215 kg. (0.475 lb.) per h.p./hr.
Fuel at cruising power 0.205 kg. (0.45 lb.) per h.p./hr.
Oil 0.2 kg./hr. (0.44 lb./hr.).



The 160 h.p. Walter Minor 6-III six-cylinder inverted air-cooled engine.

THE WALTER MINOR 6-III.

TYPE.—Six-cylinder inverted in-line air-cooled, ungeared.

CYLINDERS.—Same as for Minor 4-III. Total capacity 5.97 litres (364.31 cub. in.).

PISTONS AND CONNECTING RODS.—Same as for Minor 4-III.

CRANKSHAFT.—Six-throw crankshaft, forged from special nitrided chrome-vanadium steel and machined all over. Carried in seven two-piece steel-backed lead-bronze bearings and one ball thrust bearing at the front end.

CRANKCASE.—Assembly consists of crankcase itself, upper and front covers. Crankcase has double cross-webs in which crankshaft and camshaft bearings are mounted. All crankcase parts cast from heat-treated magnesium alloy.

VALVE GEAR.—Two parallel interchangeable valves in each cylinder, made from high duty special steel. Valve stems are nitrided. Steel valve seats pressed into the cylinder head. Camshaft on port side of crankcase, driven from crankshaft through a spur gear.

INDUCTION.—Two Walter W45 or W45-AK (aerobatic) down-draught carburettors with manual mixture control and acceleration pump.

FUEL.—72 octane minimum.

IGNITION.—Dual shielded ignition. Two Scintilla magnetos OAF 6R 402 Z171 (port) and OAF 6R 602 Z171 (starboard) with automatic sparking advance. Magnetos placed in a hanging position at rear of crankcase. Port magneto driven from camshaft, starboard magneto driven from fuel pump drive. Starboard magneto provided with impulse unit. Sparking plugs 12×1.25 mm. (PAL 12P/250 SE).

LUBRICATION AND AIRSCREW DRIVE.—Same as for Minor 4-III.

ACCESSORIES.—Type 2M-50 fuel pump (starboard side of crankcase), Scintilla 24-volt 300-watt generator (port side) and tachometer generator (starboard side) driven by train of spur gears. Tachometer driven by flexible shaft.

STARTING.—Walter type R 25 hand starter, type RE 25 hand and electric starter, or type P320 electric starter.

MOUNTING.—Two engine bearer feet on each side of crankcase, with rubber vibration dampers.

DIMENSIONS.—
Overall length without airscrew hub 1,250 mm. (49.21 in.).
Overall width without bearer feet 445 mm. (17.49 in.).
Overall height 639 mm. (25.16 in.).

WEIGHT DRY (including normal accessories).—126.8 kg. (279.5 lb.) ± 2%.

PERFORMANCE.—
Rated output at S/L. 160 h.p. at 2,500 r.p.m.
Cruising power 125 h.p. at 2,300 r.p.m.

CONSUMPTIONS.—
Fuel consumption at rated S/L. power 245 gr. (.54 lb.) per h.p./hr.
Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
Oil consumption at rated S/L. power 2-8 gr. (.0044-.018 lb.) per h.p./hr.

THE PRAGA DORIS B.

TYPE.—Six-cylinder horizontally-opposed air-cooled, geared.

CYLINDERS.—Bore 115 mm. (4.53 in.). Stroke 115 mm. (4.53 in.). Total capacity 7.167 litres (437.36 cub. in.). Compression ratio 7 : 1. Chrome-nickel steel cylinders with cooling fins and two flanges. One flange for mounting cylinder on crankcase; the other provides a seating for the head which is cast from special heat-treated aluminium alloy and bolted to the cylinder.

PISTONS.—Drop forged from aluminium alloy. Two compression rings and one double scraper ring. Hollow steel gudgeon-pins.

CONNECTING RODS.—H-section, drop forged from case-hardened steel and polished all over. Split big-ends with case-hardened bearing surface. Bronze bush pressed into little-end to provide mounting for gudgeon-pin.

CRANKSHAFT.—Six-throw crankshaft, forged from high-duty chrome-vanadium steel, machined and polished all over. Carried at each end in roller bearings and in two centre anti-friction bearings. Front end with reduction gear drive carried in lead-bronze bearing.

CRANKCASE.—Two-piece crankcase cast from heat-treated magnesium alloy. Housings for main bearings mounted in cross-webs.

VALVE GEAR.—Two inclined valves per cylinder. Inlet valves made from chrome-vanadium steel: hollow exhaust valves from chrome-tungsten steel with sodium filling. Valve seats and stem face ends are stellited. Chrome-mangan-nickel steel valve seats pressed into cylinder head. Two camshafts driven by bevel gearing from crankshaft.

INDUCTION.—Type P-110 vertical float carburettor with manual mixture control and damper.

FUEL.—67-80 octane.

IGNITION.—Two Scintilla OBF 6R 502 Z162 magnetos with automatic ignition advance. Magnetos side-by-side in hanging position on upper part of crankcase and driven through spur gears. Two type PAL L23.84 screened spark-plugs per cylinder. Dual shielded harness.

LUBRICATION.—Dry sump pressure lubrication with oil tank on engine. Gear-type oil pump with one pressure and three scavenge stages.

AIRSCREW DRIVE.—Planetary type reduction gear. Ratio 1 : 0.55172. Right-hand tractor (when looking at engine from rear). Airscrew shaft of chrome-nickel-vanadium steel with SAE 41 B-N-30 standard spline.

ACCESSORIES.—Type P245 fuel pump. Type PAL 09-9095.20 generator. Two tachometer drives.

STARTING.—Type P304 electric starter, with hand crank.

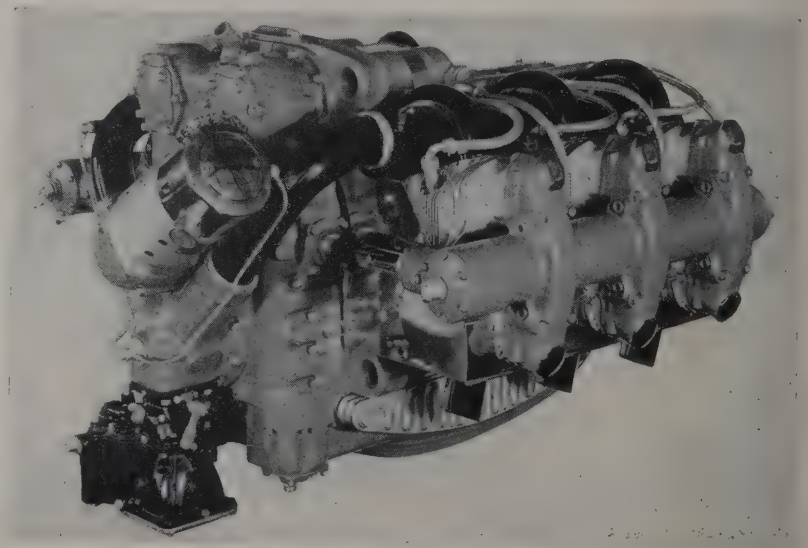
MOUNTING.—Four-point suspension with rubber vibration dampers.

DIMENSIONS.—
Overall length 1,229 mm. (48.38 in.).
Overall width 934 mm. (36.81 in.).
Overall height 611 mm. (24.06 in.).

WEIGHT DRY (without accessories, ignition harness or mounting feet).—198 kg. (436 lb.). ± 2%.

PERFORMANCE.—
Rated power 200 h.p. at 2,900 engine r.p.m.
Take-off power 220 h.p. at 3,000 engine r.p.m.
Cruising power 180 h.p. at 2,800 engine r.p.m.

CONSUMPTIONS.—
Fuel consumption at rated power 230 ± 10 gr. (.507 lb.) per h.p./hr.
Fuel consumption at take-off power 240 ± 10 gr. (.529 lb.) per h.p./hr.
Fuel consumption at cruising power 210 ± 5 gr. (.463 lb.) per h.p./hr.
Oil consumption 3-6 gr. (.0066-.013 lb.) per h.p./hr.



The 220 h.p. Praga Doris B flat-six air-cooled engine.

FRANCE

DRUINE

AVIONS ROGER DRUINE.

ADDRESS : 20, AVENUE DU GÉNÉRAL CLAVERY, PARIS (16e).

M. Roger Druine has developed a light aero-engine from the standard Volkswagen motor car engine. Known as the Ardem 4 CO2, it is particularly suitable for powering the Druine Turbulent single-seat light aircraft and is being made available in Britain by Rollason Aircraft and Engines Ltd. of Croydon Airport, Surrey.

THE ARDEM 4 CO2.

TYPE.—Four - cylinder horizontally - opposed air-cooled.

CYLINDERS.—Bore 77 mm. (3.031 in.). Stroke 64 mm. (2.52 in.). Capacity 1,192 cc. (72.62 cub. in.). Compression ratio 6.6 : 1.

PISTONS.—Light metal, with steel reinforcement. Two compression and one oil ring.

CRANKSHAFT.—One-piece forging, running in four bearings.

CRANKCASE.—Light alloy chill mould casting.

IGNITION.—Dual ignition from R.B. magneto. Two plugs per cylinder.

WEIGHT.—
Complete with exhaust stubs and accessories 54.5 kg. (120 lb.).

PERFORMANCE.—
Take-off output 30.7 h.p. at 3,000 r.p.m.

CONSUMPTION.—
Less than 9 litres (2 Imp. gallons) per hr.

POTEZ

SOCIÉTÉ DES AVIONS ET MOTEURS HENRY POTEZ.

HEAD OFFICE : 46, AVENUE KLÉBER, PARIS (XVIe).

DESIGN AND PRODUCTION WORKS : 206 RUE HENRI BARBUSSE, ARGENTEUIL (SEINE-ET-OISE).

Based on the designs and development work of its long-established Engine Design Laboratory (L.E.M.), the Société des Moteurs Henry Potez is producing aircraft piston engines with new facilities at Argenteuil, in north-west Paris.

Potez is concentrating on the development and production of a range of four, six, and eight cylinder engines. All engines use the same basic cylinder of 125 mm. × 120 mm. (4.92 in. × 4.72 in.) and all have been type-tested and extensively flight-tested. Direct injection was introduced with Type 6-D 30 and engines of the basic 6-D type are now cleared officially for 1,200 hours' operation between major overhauls.

Potez is also engaged on sub-contract work, including the manufacture of transmission components for Turbomeca Artouste turbines, of which 92 sets had been delivered by the end of January, 1957.

THE POTEZ 4-D 02.

TYPE.—Four-cylinder in-line inverted, air-cooled.

CYLINDERS.—Bore 125 mm. (4.92 in.). Stroke 120 mm. (4.72 in.). Swept volume 5.85 litres (352 cub. in.). Compression ratio 7 : 1. Nitrided steel cylinder barrel with Y-alloy die-cast cylinder heads secured by four long bolts screwing into crankcase.

PISTONS.—Y-alloy die forging. Two compression and one double scraper rings above gudgeon-pin, one scraper ring below. Floating gudgeon-pin.

CONNECTING RODS.—I-section aluminium-alloy forgings with split big-ends and split steel-backed lead-bronze lead-plated bearing. Assembly by four chrome-nickel steel bolts. Little-end floating directly on gudgeon-pin.

CRANKSHAFT.—Nickel - chrome - molybdenum steel, forged and machined. Four-throw, on five bearings. Deep-groove ball-thrust bearing at front, remainder are steel-backed lead-bronze lead-lined. Solid 60 mm. (2.36 in.) 16-splined airscrew shaft.

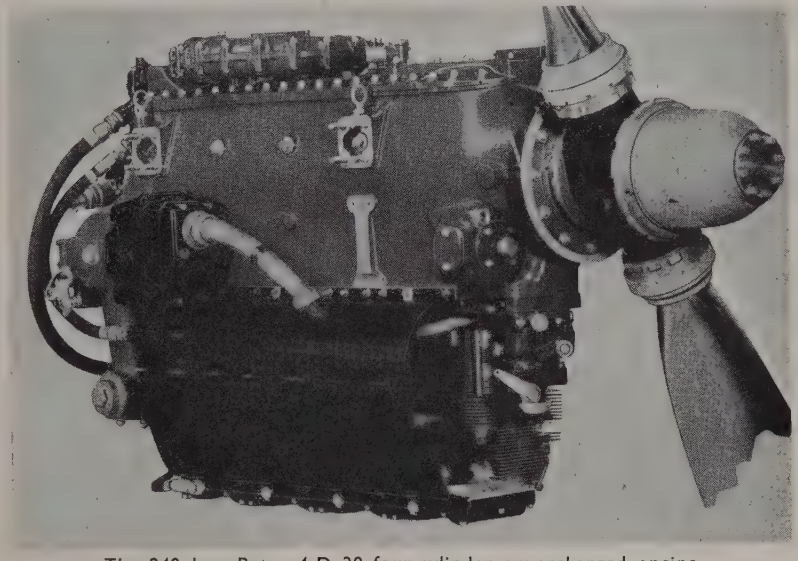
CRANKCASE.—Aluminium silicon-alloy casting with duralumin top cover. Five duralumin forged bearing caps secured by chrome-nickel steel studs. Chrome-nickel steel through-bolts at centre bearing cap. Cast magnesium-alloy oil sump in rear section of case.

VALVE GEAR.—Two symmetrically-inclined valves of nitrided austenitic steel per cylinder. Stellited sodium-cooled exhaust valves. Tin-silicon-cupronickel shrunk-in valve-seats. Single camshaft in crankcase operates all valves through roller tappets, push-rods and adjustable rocker-arms. Two shot-peened vanadium steel valve springs per cylinder.

INDUCTION.—One Hobson downdraught AI 55J carburettor with automatic altitude control. Exhaust-heated muff on induction pipe. Pressure feed by one A.M. pump type CM12.

FUEL.—80 octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

IGNITION.—One double RB type J4B magneto. Screened harness and two 14 mm. spark-plugs per cylinder.



The 240 h.p. Potez 4-D 30 four-cylinder supercharged engine.

LUBRICATION.—Dry sump type. One pressure and two scavenge pumps, fore and aft. Normal oil pressure 3.5-5.0 kg./cm.² (49.7-71.0 lb./sq. in.). Oil temperature : min. 45°C. ; max. 95°C. at inlet, 100°C. at outlet. Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

AIRSCREW DRIVE.—Direct left-hand drive. Splines conforming to B.N.Aé. 212.01. Provision for electric or hydraulic variable-pitch airscrew.

ACCESSORIES.—Drive for 24-volt 1,600-watt electric generator on right rear side of crankcase. Ratio 2.48 : 1. Tachometer drive on rear of crankcase. Ratio 1 : 2. Vacuum pump and hydraulic pump drives on rear of sump case. Ratios 1.06 : 1 and 0.67 : 1 respectively. Drive at front of crankcase for hydraulic regulator for constant speed airscrew.

STARTER.—Potez electric 24-volt direct-drive starter.

MOUNTINGS.—Four-point flexible mountings, two on each side of crankcase.

COOLING.—Three inter-cylinder deflectors, one rear deflector, and one side chute in two pieces, one movable. Maximum temperatures (at 2.400 r.p.m.) 250°C. cylinder heads, 140°C. cylinder barrels.

DIMENSIONS.—
Overall length 1,220 mm. (48.0 in.).
Overall height 720 mm. (28.35 in.).
Overall width 530 mm. (20.87 in.).

WEIGHT DRY (without accessories).—
145 kg. (320 lb.).

PERFORMANCE.—
Take-off output 165 h.p. at 2,550 r.p.m.
Normal output at sea level 155 h.p. at 2,500 r.p.m.
Max. cruising output 130 h.p. at 2,360 r.p.m.
Economic cruising output 105 h.p. at 2,260 r.p.m.

CONSUMPTIONS.—
At take-off 245 gr. (.54 lb.) h.p./hour.
At normal output (2,500 r.p.m.) 240 gr. (.53 lb.) h.p./hour.
At max. cruising 215 gr. (.47 lb.) h.p./hour.
At economical cruising 205 gr. (.45 lb.) h.p./hour.

THE POTEZ 4-D 30.

This is the previously described 4-D 02 fitted with a centrifugal blower mounted horizontally on the crankcase top cover. It has been chosen to power the Nord 3202 two-seat trainer.

The general description of the 4-D 02 applies to this engine except for the following details :—

CYLINDERS.—Same as for 4-D 02. Cylinder head shrunk on sleeve.

CONNECTING RODS.—I-section steel alloy forgings, machined all over.

INDUCTION.—Supercharged. Sealed carburettor and pressure pump as for 4-D 02.

SUPERCHARGER. — Single - stage centrifugal type. High-strength die-forged aluminium-alloy impeller driven from front end of crankshaft through ground spur teeth, ground zerol bevel gearing and slipping coupling. Ratio 15.50 : 1.

FUEL.—100 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

LUBRICATION.—Same as for 4-D 02. Pressure feed to supercharger drive. Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

DIMENSIONS.—
Same as for 4-D 02.

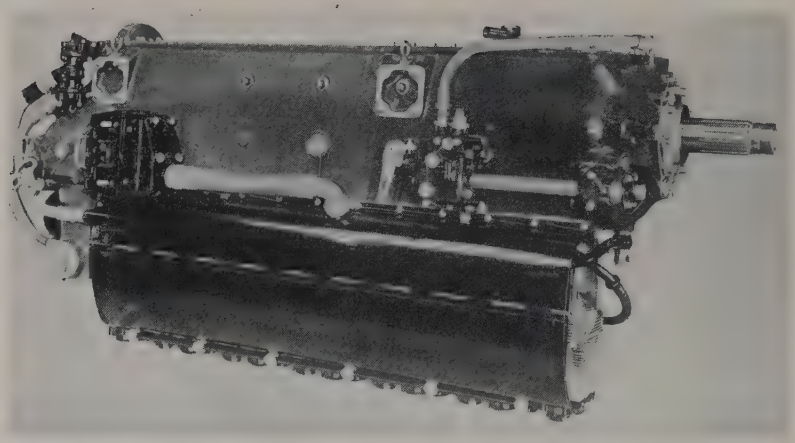
WEIGHT DRY (without accessories).—
183 kg. (403 lb.).

PERFORMANCE.—
Take-off output 240 h.p. at 2,550 r.p.m.
Normal output at 700 m. (2,300 ft.) 205 h.p. at 2,400 r.p.m.
Normal cruising output at 1,300 m. (4,400 ft.) 160 h.p. at 2,200 r.p.m.

CONSUMPTIONS.—
At take-off 290 gr. (.64 lb.) h.p./hour.
At normal output at S/L. 270 gr. (.595 lb.) h.p./hour.
At normal cruising 225 gr. (.49 lb.) h.p./hour.
At economical cruising 215 gr. (.47 lb.) h.p./hour.

THE POTEZ 6-D 02.

Officially cleared for 1,200 hours' operation between major overhauls, a 6-D 02 engine was run continuously for 1,350 hours at the Centre d'Essais des Moteurs et Hélices at Saclay early in 1957. When examined, it was in perfect condition and was re-installed for further testing. During these tests it drove an experimental airscrew which was also under test.



The 240 h.p. Potez 6-D 02 six-cylinder inverted engine.

TYPE.—Six-cylinder in-line inverted air-cooled.

CYLINDERS.—Same as for 4-D 02 except swept volume 8.83 litres (539 cub. in.).

PISTONS AND CONNECTING RODS.—Same as for 4-D 02.

CRANKSHAFT.—Six-throw, nitrided nickel-chrome-molybdenum steel, forged and machined all over. Deep-groove ball thrust bearing and seven steel-back lead-bronze lead-plated bearings. Solid splined air-screw shaft.

CRANKCASE.—Aluminium-alloy casting with dural flat top cover. Seven dural forged bearing caps secured by two and four chrome-nickel steel studs. Chrome-nickel steel through-bolts at three centre bearing caps. Seven camshaft journals. Cast magnesium-alloy oil sump in rear section of case

VALVE GEAR.—Same as for 4-D 02.

INDUCTION.—Normally aspirated. Two Hobson A.I. 55/J carburettors with automatic altitude correction and enrichment. Fuel feed by AM Type CM 13 pump. Provision for aerobatics.

FUEL.—80 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

IGNITION.—Fully VHF screened. One double RB Type J6A magneto. Two 14 mm. spark-plugs per cylinder.

LUBRICATION.—Same as for 4-D 02. Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

AIRSCREW DRIVE.—Direct, right-hand drive. Splines conforming to B.N.Ae. 212.01. Provision for hydraulic variable-pitch air-screw.

ACCESSORIES.—Drive for 24-volt 1,600-watt electric generator on left side rear of crankcase. Ratio 2.46 : 1 Tachometer drive on rear of crankcase. Ratio 0.5 : 1. Vacuum and hydraulic pump drives on rear of sump case. Ratios 1.07 : 1 and 0.67 : 1 respectively. Hydraulic airscrew regulator on right front side of crankcase. Ratio 0.5 : 1.

STARTING. — Potez electric 24-volt direct starter.

MOUNTING.—Four points, two forward and two aft of C.G.

COOLING.—Five inter-cylinder deflectors, one rear deflector and one side chute in two pieces, one movable. Maximum temperatures (at 2,500 r.p.m.) 250°C. cylinder heads, 150°C cylinder barrels.

DIMENSIONS.—
Overall length 1.550 mm. (61 in.).
Overall height 720 mm. (28.35 in.).
Overall width 530 mm. (20.87 in.).

WEIGHT DRY.—
Without accessories 235 kg. (517 lb.).

POWER RATING.—
Take-off output 240 h.p. at 2,530 r.p.m.
Normal output at sea level 230 h.p. at 2,500 r.p.m.
Max. cruising output 180 h.p. at 2,300 r.p.m.
Economic cruising output 135 h.p. at 2,100 r.p.m.

CONSUMPTIONS.—
At take-off 250 gr. (.55 lb.) h.p./hour.
At normal output (2,500 r.p.m.) 240 gr. (.53 lb.) h.p./hour.
At max. cruising 220 gr. (.48 lb.) h.p./hour.
At economical cruising 205 gr. (.45 lb.) h.p./hour.

THE POTEZ 6-D 30.

This is the above-described 6-D 02 fitted with a centrifugal blower mounted horizontally on the crankcase top-cover. The description of the 6-D 02 applies to this engine except for the following details :—

CYLINDERS.—Same as for 6-D 02. Cylinder-head shrunk-fitted on sleeve.

CONNECTING RODS.—I-section steel alloy forgings, machined all over.

INDUCTION. — Supercharged. Direct high pressure injection into cylinder head provided by Bronzavia swash-plate six-plunger pump Type 130-604 supported by crankcase at front right side and driven at camshaft speed by bevel gearing. Fully-automatic mixture control with automatic altitude and temperature controls. One injection nozzle per cylinder. No boost control. One throttle valve at supercharger outlet. First-stage fuel pump incorporated into injection pump.

SUPERCHARGER.—Same type as for 4-D 30. Ratio 14.0 : 1.

FUEL.—91 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

LUBRICATION.—Same as for 4-D 30. Pressure feed to supercharger drive. Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

ACCESSORIES.—Drive for 24-volt 1,600 watt electric generator on left rear side of crankcase. Ratio 2.46 : 1. Tachometer drive on rear of crankcase. Ratio 0.5 : 1. Vacuum pump drive on rear of sump case. Ratio 1.07 : 1. Hydraulic pump drive on rear of crankcase. Ratio 0.5 : 1. Hydraulic airscrew regulator at rear of sump case. Ratio 0.67 : 1.

COOLING.—Same as for 4-D 30. Maximum temperatures (at 2,400 r.p.m.) 255°C. cylinder heads, 160°C. cylinder barrels.

DIMENSIONS.—
As for 6-D 02.

WEIGHT DRY.—
Without accessories 260 kg. (573 lb.).

POWER RATING.—
Take-off output 325 h.p. at 2,400 r.p.m.
Normal output 260 h.p. at 2,400 r.p.m.
Max. cruising output 200 h.p. at 2,200 r.p.m.

CONSUMPTIONS. —
At take-off 300 gr. (.66 lb.) h.p./hour.
At normal output 270 gr. (.595 lb.) h.p./hour.
At max. cruising 230 gr. (.51 lb.) h.p./hour.
At economical cruising 215 gr. (.47 lb.) h.p./hour.

THE POTEZ 8-D 30 AND 8-D 32.

The 8-D 32 engine powers the Potez 75 anti-tank and artillery observation aircraft. An 8-D 30 has been fully type-tested at a rating of 520 h.p. The two engines are similar, except that the Type 8-D 32 is a pusher-type power plant with stepped-up fan.

TYPE.—Eight-cylinder 90° inverted Vee air-cooled, geared and supercharged.

CYLINDERS.—Same as for 4-D 30, except swept volume 11.78 litres (719 cub. in.).

PISTONS.—Same as for 4-D 30.

CONNECTING RODS.—Fork and blade type in nitrided nickel-chrome-molybdenum steel, with split big-ends and split steel-backed lead-bronze lead-plated bearings. Assembly by four chrome-nickel steel bolts in fork rod and two in blade rod.

CRANKSHAFT.—Four-throw 90° dynamically-balanced one-piece shaft of nitrided nickel-chrome-molybdenum steel. Five split steel-backed lead-bronze lead-plated bearings. Drive to reduction gear and camshaft from serrated flange bolted to front end of shaft. On rear end is shrunk the flexible torsion shaft to the supercharger drive.

CRANKCASE. — Aluminium - alloy monobloc casting with cast magnesium-alloy top cover. Five dual forged bearing caps, three secured by four chrome-nickel steel studs, two by two studs. Chrome-nickel steel through-bolts at three centre bearing caps. Front of the crankcase closed by reduction-gear casing, rear end by supercharger casing and accessory support. Oil sump in rear portion of case and below compressor casing.

VALVE GEAR.—Same as for 4-D 30. Single camshaft in crankcase.

INDUCTION.—Supercharged. One Zenith 95 RGSL automatic carburettor with automatic altitude control and full throttle enrichment. Forced circulation of scavenge oil round intake elbow to blower. Fuel feed by A.M. pump type CM 13.

SUPERCHARGER. — Single-stage single-speed centrifugal supercharger. Ratio 9.83 : 1.

FUEL.—100 Octane minimum. Up to 1.2 cc.'s per litre lead accepted by engine.

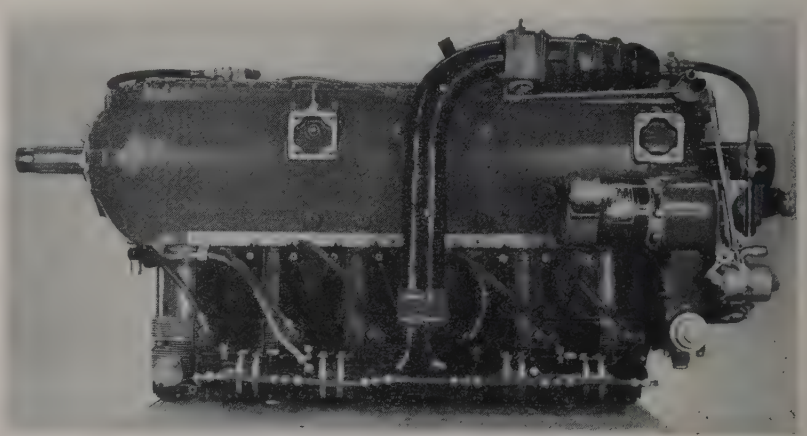
IGNITION.—Fully VHF screened. Two R.B. Type P8BA magnetos. Two 14 mm. short reach spark-plugs per cylinder.

LUBRICATION.—Dry sump type. Two pressure and three scavenge pumps. Oil pressure 35.5-71 lb./sq. in. (2.5-5 kg./cm.²). Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

REDUCTION GEAR.—Planetary type with seven satellites. Gear ratio 0.657 : 1.

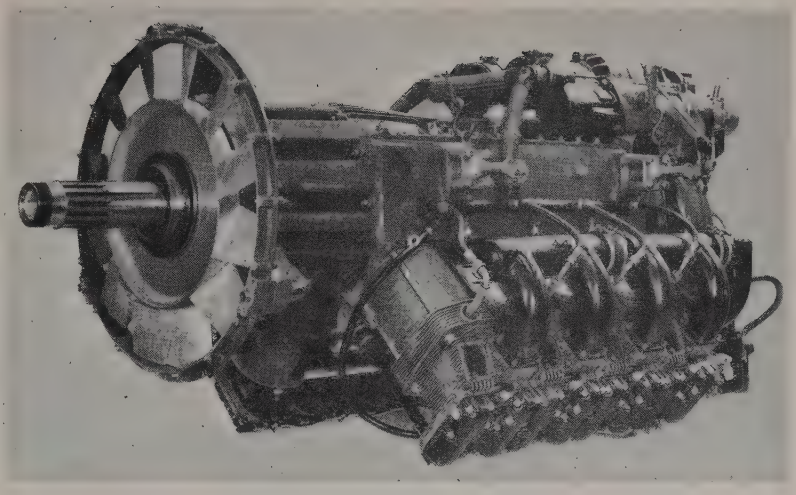
AIRSCREW DRIVE.—Direct, right-hand drive. Airscrew shaft with 16 splines 73.3 × 67.7 × 7.4. Provision for hydraulic variable-pitch airscrew.

ACCESSORIES.—Drive for 24-volt 2,500-watt electric generator over supercharger casing. Ratio 2.27 : 1. Tachometer drive on right side of supercharger casing : ratio 0.5 : 1. Vacuum pump on rear (right) of accessories support : ratio 1 : 1. Hydraulic pump on rear (left) of accessories support : ratio 1 : 1. Hydraulic airscrew regulator : ratio 0.5 : 1 at front of reduction gear casing.



The 325 h.p. Potez 6-D 30 six-cylinder supercharged engine.

STARTING.—Potez 24-volt electric starter mounted in Vee of engine.
MOUNTING.—Four-point flexible mounting, two points forward and two aft of C.G.
COOLING.—Six inter-cylinder deflectors, one rear deflector and one under-scoop. Temperatures as for 6-D 30. This engine can be supplied as a pusher-type with incorporated stepped-up fan and becomes the type 8-D 32.
DIMENSIONS.—
Overall length 1,694 mm. (66.3 in.).
Overall width 795 mm. (31.3 in.).
Overall height 802 mm. (31.6 in.).
WEIGHT DRY.—
Type 8-D 30 (without accessories) 335 kg. (738 lb.).
Type 8-D 32 (without accessories) 353 kg. (778 lb.).
POWER RATINGS.—
Take-off output 520 h.p. at 2,650 r.p.m.
Normal output at 1,900 m. (6,230 ft.) 430 h.p. at 2,650 r.p.m.
Econ. cruising output at 3,300 m. (10,825 ft.) 290 h.p. at 2,250 r.p.m.
CONSUMPTIONS.—
At take-off 310 gr. (.68 lb.) h.p./hour.
At normal output 280 gr. (.62 lb.) h.p./hour.
At max. cruising 225 gr. (.49 lb.) h.p./hour.
At economical cruising 215 gr. (.47 lb.) h.p./hour.



The 520 h.p. Potez 8-D 32 eight-cylinder inverted vee engine.

SNECMA.

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION.

HEAD OFFICE: 150, BOULEVARD HAUSSMANN, PARIS (8e.)

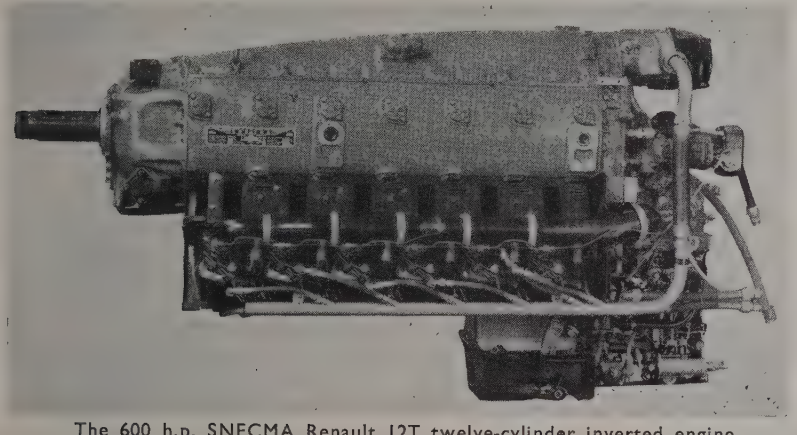
WORKS: PARIS (BOULEVARD KELLERMANN), GENNEVILLIERS (SEINE), BILLANCOURT (SEINE), SURESNES (SEINE) AND VILLAROCHE (SEINE-ET-MARNE).

President and Director-General: Henri Desbruères.
Administrative Director: M. Depallens.
Technical Director: H. Oestrich.
Director-Controller: Marcel Richer.
Commercial Director: André Esperet.
Director of External Relations: Maurice Roudil.
Director of Atomic Division: Raymond Marchal.
Personnel Manager: D. Dugue MacCarthy.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation. (SNECMA) is the successor to the Société de Moteurs Gnôme-et-Rhône which was nationalised in 1945. In 1946 Renault Aviation was incorporated in SNECMA.

The Company continues to manufacture at its Billancourt works the Renault 12T in-line inverted air-cooled engine, and is building the Hercules 759 engine under licence from the Bristol Aeroplane Co., Ltd. It also continues to service and repair the Régnier 4L, Renault 4P and 6Q and Gnôme-Rhône 14N, 14M and 14R engines, which are no longer in production.

SNECMA is now devoting the major part of its activities to the development and series production of gas-turbine engines, for details of which see under "SNECMA" in Part I of this Section.



The 600 h.p. SNECMA Renault 12T twelve-cylinder inverted engine.

THE SNECMA RENAULT 12T.

The SNECMA Renault 12T has replaced in production the SNECMA Renault 12S which has been described in previous editions of "All the World's Aircraft." The main differences between the two engines concern the pistons, supercharger and lubrication, but further details were not available at the time of writing.

DIMENSIONS.—
Length 1,366 mm. (53.7 in.).
Height 755 mm. (29.7 in.).
Width 500 mm. (19.6 in.).
PERFORMANCE.—
Take-off output 600 h.p. at 3,300 r.p.m. at S/L.
Take-off output 625 h.p. at 3,300 r.p.m. at 600 m. (1,970 ft.).
Max. continuous output 506 h.p. at 3,250 r.p.m. at 2,400 m. (7,870 ft.).
Max. cruising output 390 h.p. at 2,600 m. (8,530 ft.).
FUEL CONSUMPTIONS.—
Max. continuous 188 litres (41.3 Imp. gallons) per hour.
Max. cruising 102 litres (22.4 Imp. gallons) per hour.
Recommended cruising 84 litres (18.4 Imp. gallons) per hour.

GERMANY

THE GERMAN FEDERAL REPUBLIC

BMW

BMW STUDIENGESELLSCHAFT FÜR TRIEBWERKSBAU G.m.b.H.

HEAD OFFICE: LERCHENAUERSTRASSE 76, MUNICH 13.

WORKS: MUNICH-ALLACH AND MILBERTSHOFEN.

The nucleus of the new BMW company was formed as a "study group" in December, 1954, under the leadership of Helmuth Sachse, technical director of the former company and one-time chief of the aircraft engine division of the German Air Ministry.

Its aero-engine production centre at Munich-Allach escaped serious damage during the war and is available for production. Facilities include more than 50 engine test-beds. Many of the technicians who designed and engineered the wartime series of BMW piston, gas-turbine and rocket engines, and have since worked in Russia, France and other countries, will be available when BMW resume aero-engine production.

During 1956-57, B.M.W. began to reorganise its factory for probable production under licence of Lycoming GO-480 engines to power the Piaggio P.149 aircraft being built by Focke-Wulf and the Dornier Do 27.

The company expects also to handle the maintenance and overhaul of the Orenda 10 and 14 turbojet engines fitted to Canadair Sabre Mk. 5 and Mk. 6 aircraft of the West German Air Force.

HEINKEL

ERNST HEINKEL AKTIENGESELLSCHAFT.

HEAD OFFICE AND WORKS: HELLMUTH - HIRTH - STRASSE, STUTTGART - ZUFFENHAUSEN.

Chairman and General Manager: Alfred Klein.

Director: Hans Nürnberger.

Sales Director: F. W. Seekatz.

Chief of Development: Dr. Ing. Fritz Gosslau.

The Ernst Heinkel Aktiengesellschaft had its origin in the former Ernst Heinkel Flugzeugwerke of Warnemünde and Rostock, which began development of gas-turbine engines in 1936 and built the He S 3B turbojet which powered the Heinkel He 178, the first jet-propelled aeroplane to fly, on August 27, 1939.

After 1945, only the plant at Stuttgart-Zuffenhausen was left of the former works at Rostock, Berlin-Oranienburg, Berlin-Waltersdorf, Wien-Schwechat and Jenbach/Tirol. The development and production of small engines in the 50-1,100 cc. class was undertaken at this works, together with the production of motor scooters and three-wheeled vehicles.

To supplement these activities, it is intended to undertake the maintenance and repair of gas-turbine engines for the West German Air Force, and the design and production of aero-engines.

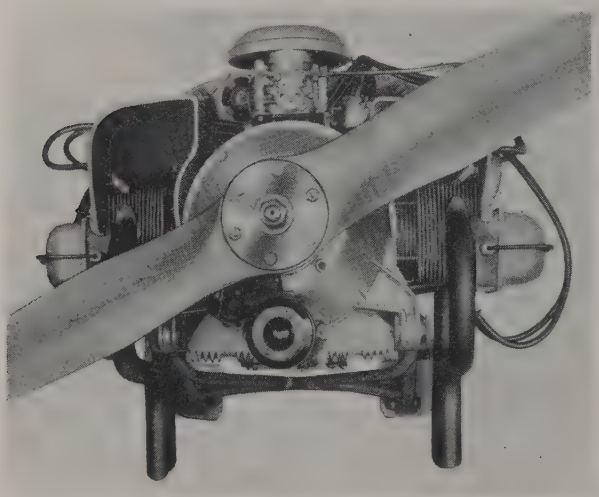
PORSCHE

F. PORSCHE K.-G.

HEAD OFFICE AND WORKS: 141 SCHWEIBERDINGERSTRASSE, STUTTGART-ZUFFENHAUSEN.

To this well-known manufacturer of sports cars has gone the distinction of producing the first aero-engine developed in Germany since the war. Known as the Porsche Type 678/1, it is a 65 h.p. air-cooled horizontally-opposed four-cylinder engine intended to meet the requirement for a power plant for the many light sporting aircraft now being built in Europe. Previously, many amateur constructors had fitted modified Porsche motor car engines to aircraft of the Jodel type with considerable success.

In addition to the Type 678 engine, Porsche has developed a lighter, simplified power plant of the same basic type, delivering 50 h.p. at 3,300 r.p.m. and weighing only 70 kg. (154 lb.). Fitted with dual ignition and carburettor pre-heat system, it is intended for very small aircraft. No further details are available.



The 65 h.p. Porsche Type 678/1 engine.

THE PORSCHE TYPE 678/1.

Before the Type 678/1 engine was put on the market, it completed successfully a 150 hour type test to British A.R.B. Certificate of Airworthiness standards at the official West German Aviation Research Centre in Brunswick. On the basis of this testing, it has been released for service with an initial overhaul period of 600 hours and is suitable for installation in aircraft with a maximum speed of up to about 200 km.h. (135 m.p.h.).

In addition to the standard version described below, there is a second model with two dual carburettors and a cooling blower. This version has been designed for installation within the fuselage of the aircraft and has a reduction gear ratio of 1.74 : 1, together with a somewhat higher power output.

Another special version is being developed to power the American Gyrodyne XRON-1 light helicopter.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 82.5 mm. (3.25 in.). Stroke 74.0 mm. (2.91 in.). Capacity 1,582 cc. (96.5 cub. in.). Compression ratio 7.5 : 1.

INDUCTION.—Dual downdraught carburettor.

FUEL GRADE.—80 octane.

LUBRICATION.—Dry sump type. Oil tank capacity 5 litres (1.1 Imp. gallons).

OIL GRADE.—Shell Rotella SAE 30.

IGNITION.—Dual magneto or dual battery ignition. Fully shielded. Two spark plugs per cylinder.

AIRSCREW REDUCTION GEAR.—Gear ratio 2.4 : 1.

ACCESSORIES.—Diaphragm type fuel pump. Wet type air filter. Bosch generator 160 watt 12 volt shielded with voltage regulator. Exhaust muffler. Heating system for cabin. Carburettor pre-heat system.

STARTING.—Electric starter.

DIMENSIONS.—
No details available.

WEIGHT.—
Dry 87 kg. (192 lb.).
With cowling and all accessories 105 kg. (232 lb.).

PERFORMANCE.—
Take-off output 65 h.p. at 4,500 r.p.m.
Max. continuous output 55 h.p. at 4,200 r.p.m.
Cruising output 50 h.p. at 4,080 r.p.m.

CONSUMPTIONS.—
Fuel (cruising) approx. 220 gr./h.p./hr. (0.48 lb./h.p./hr.).
Oil 1.5-3.5 gr./h.p./hr. (0.003-0.007 lb./h.p./hr.).

THE GERMAN DEMOCRATIC REPUBLIC

Development and production of aero-engines in East Germany is, like the construction of aircraft, carried out in a state-owned factory under the direction of the Verwaltung der Luftfahrtindustrie (Administration of the Aircraft Industry), with headquarters at Pirna (Elbe).

VERWALTUNG DER LUFTFAHRTINDUSTRIE.

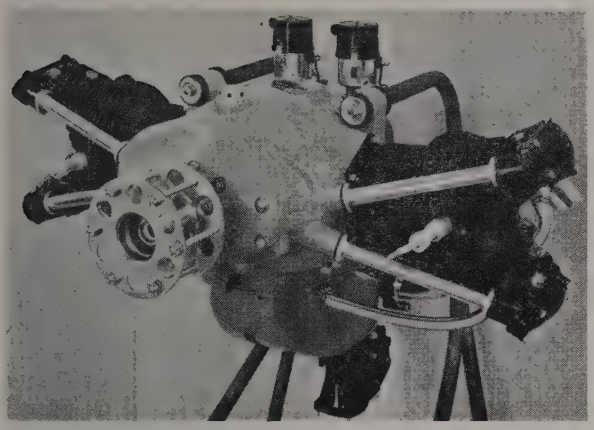
AERO-ENGINE FACTORY: INDUSTRIEWERK KARL MARX STADT, CHEMNITZ

The factory was opened in 1954 and concentrated initially on production under licence of the 1,900 h.p. Soviet ASh-82T piston-engine. This engine powers the Il-14P airliners that are being built under licence in East Germany. A description of the ASh-82T engine will be found on page 469.

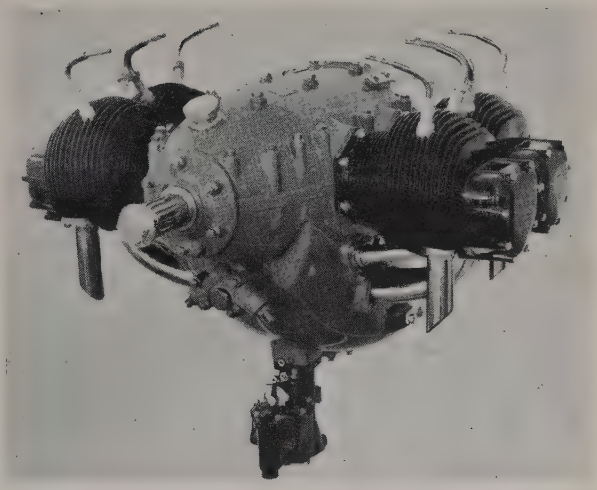
At the same time, development was started of a turbojet engine to power the nationally-designed BB-152 jet transport, but no details of this engine are available.

ITALY

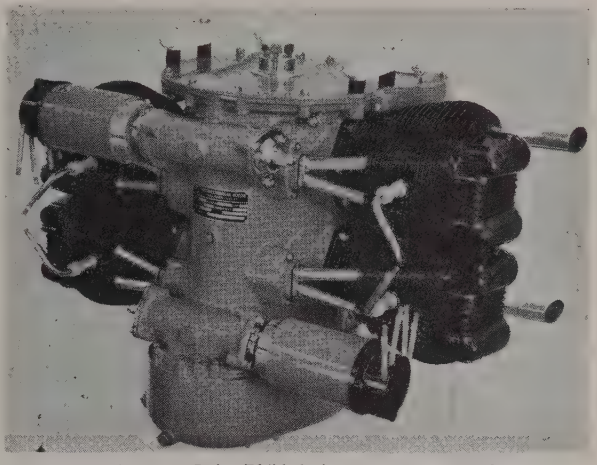
AGUSTA



The Agusta G.A. 40 two-cylinder horizontally-opposed engine.



The Agusta G.A. 70/0 four-cylinder horizontally-opposed engine.



The Agusta G.A. 70/V helicopter power plant.

MECCANICA VERGHERA AGUSTA.

HEAD OFFICE: CASCINA COSTA, GALLARATE.

ENGINE WORKS: VERGHERA, GALLARATE.

This company is the Engine Division of the Agusta company, whose airframe production is described in the "Aircraft" section of this work.

It has produced a range of completely new small piston engines for the propulsion of fixed-wing aircraft and helicopters, to the designs of M. Ginnini. These are now being bench-tested and are described briefly below.

In addition to designing and building aero-engines, Meccanica Verghera manufactures trucks and motor-cycles. Its motor-cycles have won the World's Championship in the 125 cc. and 250 cc. classes on many occasions.

THE AGUSTA G.A. 70/V.

The G.A. 70/V is a four-cylinder, horizontally-opposed air-cooled engine which has been designed to be mounted with its crankshaft vertical for helicopter propulsion. It has a float-chamber carburettor, dual ignition and electric starter. For other details see Table.

THE AGUSTA G.A. 70/0.

Basically similar to the G.A. 70/V, this engine is designed to power fixed-wing aircraft and has a conventional horizontal crankshaft. For other details see Table.

THE AGUSTA G.A. 40.

Smallest of the current range of Agusta engines, the G.A. 40 is a two-cylinder horizontally-opposed air-cooled engine which is in limited production to power a motorised glider for the Italian Air Force. For other details see Table.

AGUSTA HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Rated Output at Sea Level	Capacity	Weight Dry	Overall Length	Overall Width	Overall Height
G.A.40	2	42 h.p. at 2,700 r.p.m.	1,486 cc. (90.68 cub. in.)	39 kg. (86 lb.)	550 mm. (21.65 in.) (less carb.)	785 mm. (30.90 in.)	440 mm. (17.32 in.) (less carb.)
G.A.70/0	4	72 h.p. at 3,100 r.p.m.	2,300 cc. (140.4 cub. in.)	68 kg. (150 lb.)	750 mm. (29.53 in.)	745 mm. (29.33 in.)	450 mm. (17.72 in.) (less carb.)
G.A.70/V	4	72 h.p. at 3,100 r.p.m.	2,300 cc. (140.4 cub. in.)	67 kg. (147.7 lb.)	540 mm. (21.26 in.) (over carb.)	735 mm. (28.94 in.)	580 mm. (22.83 in.)

ALFA

SOCIETÀ per AZIONI ALFA ROMEO.

HEAD OFFICE: VIA MARCO ULPIO TRAIANO 33, MILAN.

AERO-ENGINE WORKS: POMIGLIANO D'ARCO, NAPLES.

This company, manufacturers of the well-known Alfa-Romeo automobile, entered the Italian aero-engine industry in 1925 with the acquisition of the Jupiter engine licence from the Bristol Aeroplane Co., Ltd., and the Lynx engine licence from Armstrong Siddeley Motors, Ltd. In 1930, the company produced its first engine of original design, the D2, and remained an important manufacturer of piston-engines for Italian aircraft until 1956.

Pending conversion of its plant for the manufacture of gas-turbine engines, Alfa Romeo is restricting its aero-engine work to the overhaul of piston-engines of up to 3,500 h.p., turbojet and turboprop engines.

POLAND

In common with the airframe industry, Polish aero-engine factories were engaged mainly in producing equipment of Soviet design until recently, when development of nationally-designed engines has again been encouraged.

Several Russian aero-engines are still in production in Poland, notably the M-11FR five-cylinder air-cooled radial, rated at 140 h.p. at 1,760 r.p.m., with a maximum power of 160 h.p. at 1,900 r.p.m., and the AI-14R seven-cylinder air-cooled radial, which develops a maximum of 260 h.p.

Details of turbojet and pulse-jet engines produced in Poland are given in the "Gas-Turbines" section of this work.

NARKIEWICZ

DIPL. ING. WIKTOR NARKIEWICZ.

Best known Polish aero-engine designer at the present time is Dipl. Ing. Wiktor Narkiewicz who, as head of the Avia works, supervised construction of the pre-war WZ-7 and WZ-100 radial engines and was engaged on engine research in Britain during the war.

In 1946 he became a chief designer of the Aero-engine Department of the P.Z.L. and designed the first post-war Polish engine, the 65 h.p. WN-1, which was ordered by the Department of Civil Aviation of the Ministry of Communications. Three prototypes of the WN-1 were built and completed successfully a full programme of ground and flight testing. Work on the WN-1 was abandoned when the Department of Civil Aviation was dissolved.

In 1947, Narkiewicz designed the 285 h.p. WN-2 to an official specification, and this engine was ready for production in 1950, when it was abandoned in favour of the licence-built Soviet AI-14.

Narkiewicz started work on a new engine, the 300 h.p. WN-3 seven-cylinder air-cooled radial, in 1952. The prototype was completed in 1954 and all testing was finished before the end of 1955, the maximum power being increased under development to 340 h.p. at 2,500 r.p.m. with no increase in weight. The WN-3 is now in large-scale production, mainly for the TS-8 Bies trainer, and a special version known as the WN-4 has been developed to power the Zuk helicopter. A description of the WN-3 follows hereafter.

The next engine designed by Narkiewicz, the 500 h.p. WN-5 supercharged radial of 1955, received no official support and was not built. But the 180 h.p. WN-6 is being tested in prototype form and will be fitted in three aircraft of various types now being built in Poland. It is expected to go into large-scale production in due course.

Meanwhile, Narkiewicz is reported to be preparing a design study for a turbo-prop engine in the 1,000 h.p. class.

THE NARKIEWICZ WN-3.

TYPE.—Seven-cylinder radial air-cooled.

CYLINDERS.—Bore 135 mm. (5.31 in.). Stroke 134 mm. (5.27 in.). Capacity 13.4 litres (820 cub. in.). Compression ratio 6.2 : 1. Nitrided steel barrels and aluminium alloy cylinder heads.

CRANKSHAFT. — Two-piece counterbalanced shaft, carried in two roller and one ball bearing.

CRANKCASE.—Cast in two halves in aluminium alloy.

VALVE GEAR.—One inlet and one exhaust valve per cylinder with induction-hardened stems, actuated by push-rod and rocker system.

INDUCTION.—One K-14WN carburettor with manually-operated altitude mixture control. One BNK-12 fuel pump.

FUEL.—72 octane minimum.

IGNITION.—Two BSM-7M magnetos with fully-screened harness. Two M-18 plugs per cylinder.

LUBRICATION.—Dry sump system. One Kuno oil filter. Pressure-lubricated valve rockers. Normal oil pressure 5-6 kg./cm.^{2} (71-86 lb./sq. in.).

AIRSCREW SHAFT.—SAE No. 20 standard spline. One oil channel for a variable-pitch airscrew.

ACCESSORIES.—1,500 watt generator, gear ratio 2.31 : 1; compressor, gear ratio 0.8 : 1; vacuum pump, gear ratio 0.8 : 1; and constant speed unit, gear ratio 1 : 1.

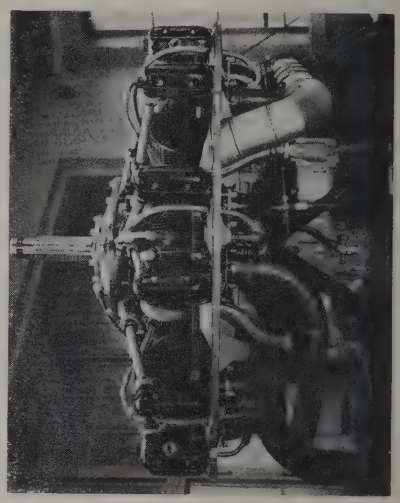
STARTING.—Compressed air starting.

DIMENSIONS.—
Diameter 1,106 mm. (43.5 in.).
Length 885 mm. (34.9 in.).
Frontal area 0.96 m.^{2} (10.3 sq. ft.).

WEIGHT DRY.—
240 kg. (530 lb.).

PERFORMANCE.—
Take-off power 320 h.p. at 2,350 r.p.m.
Max. power (5 min.) 340 h.p. at 2,500 r.p.m.
Normal continuous power 285 h.p. at 2,250 r.p.m.
Economical cruise power 240 h.p. at 2,100 r.p.m.

CONSUMPTIONS.—
Fuel at cruising power 215 gr. (0.48 lb.) per h.p./hr.
Oil at cruising power 5 gr. (0.011 lb.) per h.p./hr.



The 340 h.p. Narkiewicz WN-3 engine.

SOVIET UNION

(The Union of Soviet Socialist Republics)

Russian piston engines, with the exception of a few types of low-powered radial engines, have been mainly developments of foreign designs. The VK Series was based on the French Hispano-Suiza 12Y liquid-cooled twelve-cylinder vee; the M.25, 62 and 63 Series were derived from the American Wright R-1820 Cyclone; the M.88 and 89 from the French Gnôme-Rhône 14R; the AM.38 and 42 were based on the German BMW VI twelve-cylinder liquid-cooled engine; the ASh. 82 was a development of the American Pratt & Whitney R-1830 Twin-Wasp; the ASh.90 is a copy of the Wright R-3350 engine which was produced to power the Russian copies of the B-29. Most of these engines have been subject to development.

Aero-engine research and development is undertaken by the TsIAM (founded in 1930) and all production is handled by State factories. The various engine models are the products of design teams led by responsible engineers. For example, the design of the VK Series is attributed to V. Y. Klimov; the AM Series to Aleksandir Mikulin; and the ASh and M Series to A. D. Shvetsov. For details of the various piston engines already mentioned reference should be made to previous editions of "All the World's Aircraft." Brief details of Russian jet engine development will be found in the Gas Turbine Section of this edition.

A I

A. IVCHENKO.

In post-war years a series of piston-engines has been developed by A. Ivchenko for installation in light aeroplanes, and especially helicopters.

This designer is a newcomer to the Russian aeronautical scene, and full technical details of the motors are so far lacking. Those which have been mentioned are listed below.

THE AI-4G.

This power unit was designed for ultra-light helicopters and was used to power the Ka-10. It gives 55 h.p. at 4,500 r.p.m.

THE AI-14R.

The AI-14R is installed in the Yak-12 monoplane. It is a nine-cylinder radial air-cooled engine of 220 h.p. This motor is also used in the Ka-15.

THE AI-26B.

The most powerful Ivchenko engine so far announced is the AI-26B, which is used to power the Mi-1 helicopter. It is a seven-cylinder air-cooled radial engine giving 575 h.p. at 2,200 r.p.m.

ASH

A. D. SHVETSOV.

THE ASH-82T.

The ASh-82T was developed by the Soviet designer A. D. Shvetsov from the Pratt & Whitney Twin Wasp design. It is in production in both Russia and East Germany, and the following details were supplied from Germany.

TYPE.—Fourteen-cylinder two-row air-cooled radial, geared and supercharged.

CYLINDERS.—Bore 155.5 mm. (6.12 in.). Stroke 155 m. (6.10 in.). Displacement 41.2 litres (2,513 cub. in.). Nitrided steel barrel with cast aluminium alloy head. Compression ratio 6.9 : 1.

PISTONS.—Of forged aluminium. Each piston has three compression rings, one oil scraper ring and one oil seal ring. Upper compression ring of chromium-plated steel, remainder of cast iron. Bearing surfaces graphited. Gudgeon pins secured against axial movement by mushroom heads.

CONNECTING RODS.—Master rod and six articulated rods for each row. All rods of forged steel, heat-treated and polished. Bearings of lead-coated bronze.

CRANKSHAFT.—Three-piece crankshaft of heat-treated forged chrome-nickel-molybdenum steel. Bearing surfaces nitrided. Supported in three roller bearings.

CRANKCASE.—Made up of front housing, six-part centre housing, front and rear supercharger casings, and rear cover, all joined together by set-screws and studs. Centre housing containing cylinders is of steel, all other parts of light alloy. Front housing contains reduction gear and drives for magneto, airscrew governor and oil pump.

VALVE GEAR.—One inlet and one exhaust valve per cylinder, of heat-resisting steel. Exhaust valves are hollow and sodium-filled. Each row of cylinders has independent valve gear, consisting of camshaft, push-rods, valve levers, springs and valves.

INDUCTION SYSTEM.—Direct injection system, with injection pump on rear cover.

FUEL GRADE.—Not less than 95 octane.

SUPERCHARGER.—Single-stage type. Drive from crankshaft to light alloy impeller through reduction gearing with 7.27 : 1 ratio.

LUBRICATION.—Two oil pumps, one for each row.

IGNITION.—Two magnetos on front housing. Screened ignition harness.

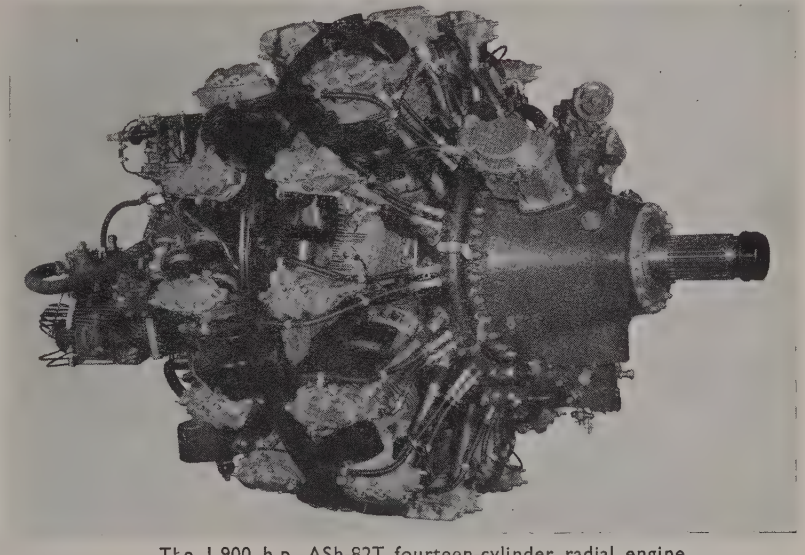
AIRSCREW DRIVE.—Provision for four-blade hydraulically - operated constant - speed variable-pitch airscrew with fluid de-icing. Reduction gear ratio 54 : 31.

DIMENSIONS.—
Diameter 1,300 mm. (51.18 in.).
Length 2,010 mm. (79.13 in.).

WEIGHT DRY.—
1,020 kg. (2,250 lb.).

PERFORMANCE.—
Take-off output (5 min.) at S/L 1,900 h.p. at 2,600 r.p.m.
Rated power at S/L 1,530 h.p. at 2,400 r.p.m.
Rated power at 1,600 m. (5,250 ft.) 1,630 h.p. at 2,400 r.p.m.

CONSUMPTIONS.—
Take-off power 617-655 kg./hr. (1,360-1,444 lb./hr.).
Rated power 435-480 kg./hr. (959-1,058 lb./hr.).



The 1,900 h.p. ASh-82T fourteen-cylinder radial engine.

SPAIN

E.N.M.A.

EMPRESA NACIONAL DE MOTORES DE AVIACIÓN S.A.

HEAD OFFICE: CALLE DE ANTONIO MAURA 4, MADRID.

WORKS: PASEO DEL GENERAL MOLA, 39, BARCELONA, AND CARRETERA DE SAN ADRIAN S/N, SAN ANDRES, BARCELONA.

President: Ilmo. Sr. D. Modesto Aguilera Morente.

Managing Director: Jose Antonio del Val.

The Empresa Nacional de Motores de Aviación, which took over the Elizalde organization on January 1, 1952, continues to manufacture the Tigre G-IV four-cylinder inverted air-cooled engine, of which there are two models A and B with outputs of 125 and 150 h.p. respectively, the 500 h.p. Sirio VII-2 seven-cylinder radial and the 775 h.p. Beta B-4 nine-cylinder radial.

Under development are the 275 h.p. Alcion seven-cylinder radial, the 90 h.p. Flecha flat-four and the Tigre G-5. The Tigre G-5 is similar to the G-IV-B engine but will be specially equipped for inverted flying and aerobatics.

The E.N.M.A. Tigre in both its 125 and 150 h.p. versions powers the C.A.S.A.-built Bücker 131 and various H.M. light aircraft built by AISA. The E.N.M.A. Sirio radial powers the C.A.S.A. 201 twin-engined commercial monoplane and the Hispano HS-42 single-engined trainer. The E.N.M.A. Beta radial powers the C.A.S.A. 202 twin-engined commercial monoplane and the Hispano HA-100-E1 single-engined advanced trainer.

E.N.M.A. have the licence to build the Turbomeca Marboré II turbojet engine, and are responsible for overhauling the Turbomeca-built Artouste turbines imported by Aerotecnica for their helicopters.

THE E.N.M.A. SIRIO S-VII-2.

TYPE.—Seven-cylinder radial air-cooled, supercharged.

CYLINDERS.—Bore 150 mm. (5.9 in.). Stroke 145 mm. (5.75 in.). Capacity 17.93 litres (1,090 cub. in.). Compression ratio 6 : 1. Finned steel barrels with cast aluminium head screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.

PISTONS.—Aluminium alloy. Floating gudgeon-pins. Three compression rings and two scraper rings.

CONNECTING RODS.—Master rod and six auxiliary connecting-rods carried on wrist pins. Special bronze little-end bearings.

CRANKSHAFT.—Single-throw shaft in two halves clamped and keyed together. On two roller bearings and one ball bearing for the tail shaft.

CRANKCASE.—Main case and compressor casing made in one piece, from "RR-53" light alloy.

VALVE GEAR.—Fully-enclosed valve gear comprising push-rods, rocker-arms, etc. with pressure lubrication and scavenge return.

CARBURATION.—One double down-draught IRZ Type A-72-D.E carburettor with heater, warm air intake and automatic boost control.

SUPERCHARGER.—Centrifugal type with a gear ratio of 7.85 : 1.

FUEL GRADE.—87 octane minimum.

LUBRICATION.—Four pumps in the lower part of the rear crankcase, one pressure and three scavenge pumps. A filter at the outlet of the pressure pump is easily accessible for cleaning. Oil pressure 4 kg./cm.^{2} (56.8 lb./sq. in.).

IGNITION.—Two FEMSA magnetos, type MAQ 71-1 with automatic advance on right-hand side, type MAQ 71-2 on left-hand side. Two AC-LS-87, Lodge type RS-19-2RS or KLG type RC-19/1R plugs per cylinder. Armoured ignition. Shielded harness.

AIRSCREW DRIVE.—Direct drive, using standard SAE 40 shaft.

ACCESSORIES.—Fuel pump, airscrew control, tachometers, connections for temperature and pressure gauges for fuel, oil, etc., mounted on the accessories casing. QBI vacuum pump, LOP hydraulic pump, and FEMSA Marelli type D.N.V.1 electrical generator mounted on a gearbox attached to the lower portion of the accessories casing and mechanically-driven from the crankshaft.

STARTING.—FEMSA type AR-152-1 or Bendix type 36 E002 electric starter.

MOUNTING.—Seven flexible mounting points situated symmetrically around the compressor casing.

DIMENSIONS.—
Overall diameter 1,120 mm. (44.1 in.).
Length 1,161 mm. (45.71 in.).

WEIGHT.—
356 kg. (785 lb.).

PERFORMANCE.—
Max. output for 5 min. only 500 h.p. at 2,300 r.p.m.
Normal output 440 h.p. at 2,100 r.p.m. at 2,100 m. (6,890 ft.).
Max. cruising output 330 h.p. at 1,960 r.p.m. at 3,500 m. (11,500 ft.).
Recommended cruising output 310 h.p. at 1,900 r.p.m. at 3,600 m. (11,800 ft.).

CONSUMPTIONS.—
Normal output: fuel 280 gr. (.617 lb.) per h.p./hr., oil 12 gr. (.0264 lb.) per h.p./hr.
Cruising: fuel 250 gr. (.551 lb.) per h.p./hr., oil 8 gr. (.0176 lb.) per h.p./hr.

THE E.N.M.A. BETA B-4.

TYPE.—Nine-cylinder radial air-cooled, supercharged.

CYLINDERS.—Bore 155.5 mm. (6.1 in.). Stroke 174.6 mm. (6.8 in.). Capacity 29.85 litres (1,820 cub. in.). Compression ratio 6.4 : 1. Finned steel barrels with cast aluminium-alloy heads screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.

CRANKSHAFT.—Single-throw shaft in two pieces clamped and keyed together. Shaft runs on two roller bearings and one ball thrust bearing.

CRANKCASE.—Made in two portions from "RR-56" light alloy forgings.

VALVE GEAR.—Fully-enclosed, with pressure lubrication and scavenge return.

CARBURATION.—One IRZ four-barrel down-draught carburettor.

SUPERCHARGER.—Centrifugal type. Gear ratio 8.31 : 1.

FUEL GRADE.—87 Octane minimum.

LUBRICATION.—One pressure and one scavenge pump. Oil pressure 3.5-5.5 kg./cm.^{2} (49-77 lb./sq. in.).

IGNITION.—Two FEMSA MAQ-9, type GN9-12D-F1-R or Rotax magnetos mounted on the accessory casing. Two ISA, Bosch, AC, KLG, Beru or similar plugs per cylinder. Shielded harness.

AIRSCREW DRIVE.—Direct drive, using standard SAE 40 shaft.

ACCESSORIES.—Fuel pump and airscrew control mounted above the accessories casing. Tachometers, connections for temperature and pressure gauges for fuel, oil etc., mounted on the accessories casing. QBI vacuum pump, LOP hydraulic pump, Nova type NA04 or similar pressure pump and FEMSA Marelli type D.N.V.1 electrical generator mounted on a gearbox attached to the lower portion of the accessories casing and mechanically-driven from the crankshaft.

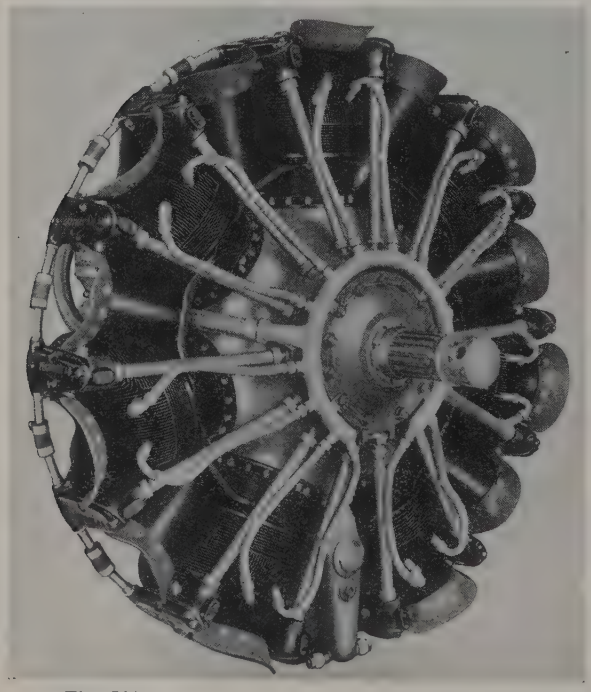
STARTING.—FEMSA type AR-152-1 or Bendix type 36 E002 electric starter.

MOUNTING.—Nine flexible mounting points situated symmetrically around the compressor casing.

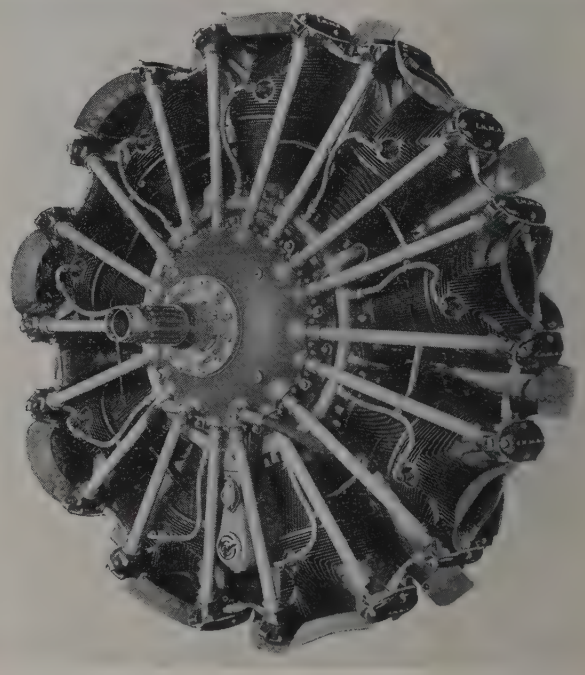
DIMENSIONS.—
Diameter. 1,386 mm. (54.6 in.).
Length 1,170 mm. (46 in.).

WEIGHT.—
485 kg. (1,070 lb.).

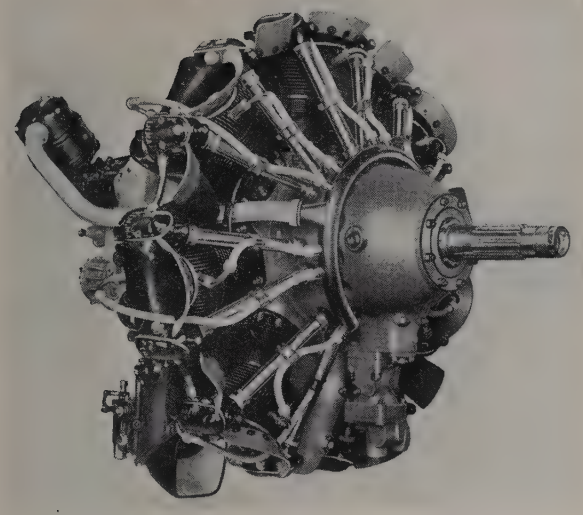
PERFORMANCE.—
Take-off output 775 h.p. at 2,200 r.p.m.
Normal output 750 h.p. at 2,100 r.p.m. at 2,900 m. (9,510 ft.).
Cruising output 550 h.p. at 1,600 r.p.m. at 3,000 m. (9,840 ft.).



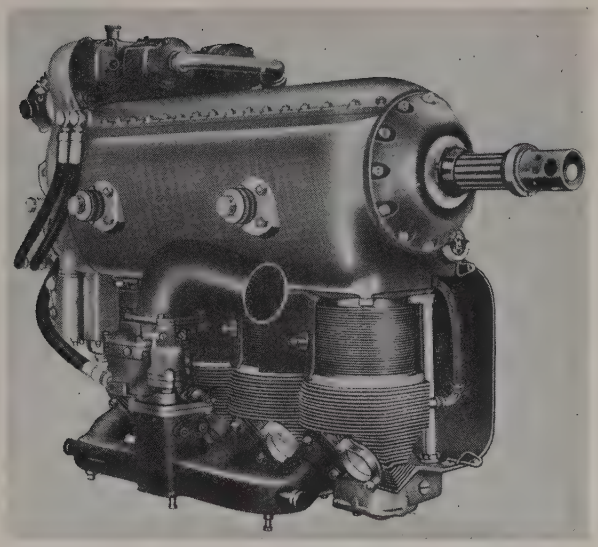
The 500 h.p. E.N.M.A. Sirio S-VII-2 radial engine.



The 775 h.p. E.N.M.A. Beta B-4 radial engine.



The 275 h.p. E.N.M.A. Alcion A-I radial engine.



The 150 h.p. E.N.M.A. G-IV-B5 in-line engine.

CONSUMPTIONS.—
Fuel (cruising) 250 gr./h.p./hr. (.55 lb./h.p./hr.).
Oil (cruising) 8 gr./h.p./hr. (.0176 lb./h.p./hr.).

THE E.N.M.A. ALCION A-1.

The E.N.M.A. Alcion, which is being developed for both horizontal and vertical installations, is a seven-cylinder geared and supercharged air-cooled radial. The following are its principal particulars :—

TYPE.—Seven-cylinder radial air-cooled, geared and supercharged.
CYLINDERS.—Bore 110 mm. (4.33 in.). Stroke 110 mm. (4.33 in.). Capacity 7.317 litres (446 cub. in.). Compression ratio 6.5 : 1. Cast from "Y" alloy with integral fins. Heads screwed on.
PISTONS, CONNECTING RODS, CRANKSHAFT.—Similar to those of Sirio S-VII-2.
CRANKCASE.—Separate light alloy casings for the reduction gear, transmission, cylinders (in two portions), compressor and accessories.
VALVE GEAR.—Similar to that of Sirio S-VII-2.
CARBURATION.—Updraught carburettor.
SUPERCHARGER.—Centrifugal. Gear ratio 7.979 : 1.
FUEL GRADE.—100 Octane.
IGNITION.—Two FEMSA magnetos with automatic advance. Two 18 mm. sparkplugs per cylinder.
LUBRICATION.—Pressure type. Four pumps. Oil pressure 5 kg./cm.² (71.1 lb./sq. in.).
AIRSCREW REDUCTION GEAR.—Planetary. Gear ratio 0.66 : 1. Standard SAE 20 shaft.
ACCESSORIES.—BS-6000.SS fuel pump, Nova type NA04 pressure pump, LOP hydraulic pump and FEMSA Marelli type DNA-301-2 electric generator mounted on the accessories casing. Airscrew control mounted on the lower portion of the reduction gear casing.
STARTING.—FEMSA type AR-154-1 electric starter.
MOUNTING.—Seven flexible mounting points situated symmetrically around the compressor casing.
DIMENSIONS.—
Diameter 0,850 mm. (33.46 in.).
Length 1,166 mm. (45.90 in.).
WEIGHT.—
225 kg. (495 lb.).
PERFORMANCE.—
Take-off output 275 h.p. at 3,000 r.p.m.
Normal output 250 h.p. at 2,800 r.p.m. at 1,500 m. (4,920 ft.).
Cruising output 175 h.p. at 2,400 r.p.m. at 2,000 m. (6,560 ft.).
CONSUMPTIONS.—
Fuel (cruising) 210 gr./h.p./hr. (.46 lb./h.p./hr.).
Oil (cruising) 8 gr./h.p./hr. (.0176 lb./h.p./hr.).

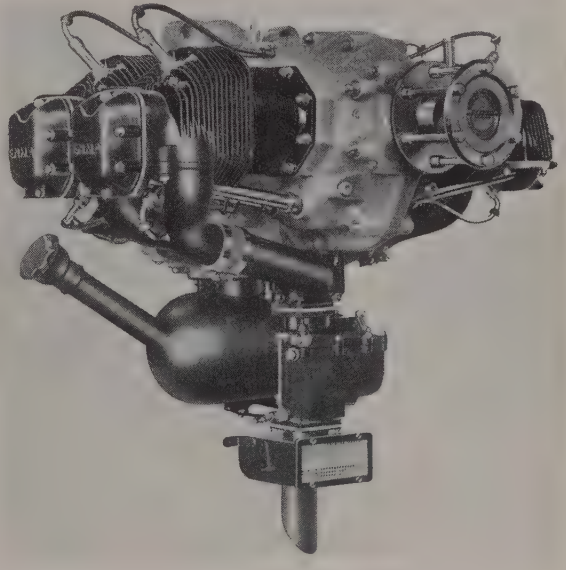
THE E.N.M.A. FLECHA F-IV-1.

The Flecha is an air-cooled flat-four engine which is being built in prototype form. The following are its principal particulars.

TYPE.—Four-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 105 mm. (4.1 in.). Stroke 100 mm. (3.9 in.). Capacity 3.46 litres (211 cub. in.). Compression ratio 7 : 1. Steel cylinders with light alloy heads.
CRANKSHAFT.—One-piece steel forging with four throws and running on three bearings.
CRANKCASE.—Aluminium alloy case in two parts, split in vertical plane.
VALVE GEAR.—One inlet and one exhaust valve per cylinder.
CARBURATION.—"IRZ," Stromberg NA-SE A1 or similar carburettor. BS-6000 SS fuel pump.
FUEL GRADE.—87 Octane minimum.
IGNITION.—Two FEMSA type ME.41-1 and ME.41-2 magnetos. Two Champion C.24S, AC type LS.86 or similar spark-plugs per cylinder. Order of firing 1-3-2-4. Shielded harness.
LUBRICATION.—Pressure type. Maximum pressure 4 kg./cm.² (56.8 lb./sq. in.) minimum pressure 1.5 kg./cm.² (21.3 lb./sq. in.).
AIRSCREW DRIVE.—Direct drive, using standard SAE 1 shaft.
ACCESSORIES.—FEMSA type DNA-301-1 300-watt 24-volt generator.
STARTING.—FEMSA type AR-154-1 electric starter.
MOUNTING.—Four flexible mounting points, two above and two below the crankcase.
DIMENSIONS.—
Width 804 mm. (31.64 in.).
Length 809 mm. (31.84 in.).
Height 628 mm. (24.72 in.).
WEIGHT.—
85-90 kg. (187-198 lb.).
PERFORMANCE.—
Nominal output 90 h.p. at 2.500 r.p.m.
CONSUMPTIONS.—
Fuel (max.) 250 gr./h.p./hr. (.551 lb./h.p./hr.).
Oil (cruising) 9 gr./h.p./hr. (.0198 lb./h.p./hr.).

THE E.N.M.A. TIGRE G-IV-A5 AND G-IV-B5.

TYPE. — Four-cylinder in-line inverted air-cooled.
CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 140 mm. (5.512 in.). Capacity 6.3 litres (386.3 cub. in.). Compression ratio 6 (IVA) or 6.5 (IVB) : 1. Cast Y-alloy cylinder heads. Forged and machined chrome-molybdenum steel barrels. Heads screwed on to barrels. Aluminium - bronze inlet valve seats. Austenitic steel exhaust valve seats.
PISTONS.—Aluminium-alloy. Fully-floating gudgeon-pins.
CONNECTING RODS.—Forged aluminium-alloy. Copper-lead big-end bearings. Special bronze small-end bearings.
CRANKSHAFT.—Forged and machined chrome-nickel steel four-throw shaft on four copper-lead main bearings and one ball thrust bearing.
CRANKCASE.—Main case of Elektron on the G-IV-A and of "RR-53" alloy on the G-IV-B. Rear casing of Elektron.
CARBURATION.—IRZ type A-56 IE (G-IV-A) or A-56-IE.B (G-IV-B) inverted carburettor.
FUEL GRADE.—80 Octane.
IGNITION.—Two FEMSA magnetos, type MVE.4-109A/B.
LUBRICATON. — Pressure by five pumps driven from rear end of camshaft. Triple oil filter. Oil pressure 2-4 kg./cm.² (28.4-56.8 lb./sq. in.).
ACCESSORIES.—Type BS 6000 SS fuel pump and FEMSA type DNA 301-2 electric generator mounted on accessories casing.
STARTING.—FEMSA type AR-154-1 electric starter.
DIMENSIONS.—
Length 1,128 mm. (44.33 in.).
Width 400 mm. (15.76 in.).
Height 757 mm. (29.82 in.).
WEIGHT (G-IV-A).—
135 kg. (297 lb.).
WEIGHT (G-IV-B).—
147 kg. (323 lb.).
PERFORMANCE (G-IV-A).—
Normal output 125 h.p. at 2,000 r.p.m.
Cruising output 100 h.p. at 1,850 r.p.m.
PERFORMANCE (G-IV-B).—
Normal output 150 h.p. at 2,300 r.p.m.
Cruising output 120 h.p. at 2,140 r.p.m.
CONSUMPTIONS.—
At cruising output (70% power).
Fuel 225 gr. (.496 lb.) per h.p./hr.
Oil 8 gr. (.0176 lb.) per h.p./hr.



The 90 h.p. E.N.M.A. Flecha F-IV-1 flat-four engine.

UNITED STATES OF AMERICA

CONTINENTAL

THE CONTINENTAL MOTORS CORPORATION, AIRCRAFT ENGINE DIVISION.

HEAD OFFICE : MUSKEGON, MICH.

WORKS : MUSKEGON AND DETROIT, MICH.

President and General Manager : C. J. Reese.

Vice-President in charge of Sales and Service, Aircraft Division : D. H. Hollowell.

Chief Engineer, Aircraft Division : W. A. Wiseman.

Treasurer : H. W. Vandeven.

In 1928, Continental Motors Corporation, one of the largest automobile engine manufacturers in the World, produced its first aero-engine, a sleeve-valve radial air-cooled incorporating the Argyll (Burt-McCollum) patents, which had been purchased by the Corporation from the British Argyll Company in 1925.

In 1931 the 38 h.p. A40 flat-four was put on the market. This was followed by the A50, A65, A75 and A80 engines.

The current range of Continental light aircraft engines includes the A65-8, C85-12, C90-12F, O-300-A and B, GO-315-A, O-470-E, G, H, J, K, L and M, O-470-2, GSO-526-A and FSO-526-A (helicopter engine).

Continental Aviation and Engineering Corporation, a subsidiary of Continental Motors Corporation, holds a licence to manufacture the French Turbomeca range of gas-turbine engines. Details of Continental gas-turbine engines will be found in Part 1 of this Section.

THE CONTINENTAL A65 SERIES.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore $3\frac{5}{8}$ in. (98.43 mm.). Stroke $3\frac{5}{8}$ in. (92 mm.). Capacity 171 cub. in. (2.8 litres). Compression ratio 6.3 : 1. Heat-treated cast aluminium alloy heads screwed and shrunk on to forged-steel barrels. Valve-seat inserts and spark-plug bushings of aluminium-bronze. Bronze valve-guides.

PISTONS.—Lo-Ex duralumin-alloy. Trunk type. Full floating gudgeon-pin located by end-plugs. Two compression and one scraper rings above gudgeon-pins.

CONNECTING RODS.—Forged steel. Split big-ends carry replaceable thin-shell steel-backed Tri-metal bronze bearings. Bronze bushings pressed into gudgeon-pin ends.

CRANKSHAFT.—One-piece, four-throw, chromium-nickel-molybdenum steel forging, drilled for lubrication, runs in three steel-backed Tri-metal bronze bearings, one of which is at middle of shaft.

CRANKCASE.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft. Rigid transverse webs carry main bearings and camshaft journals. Rawhide seal prevents oil leakage at airscrew. Four engine-mounting bosses for $\frac{3}{8}$-in. (9.5 mm.) bolts at rear of crankcase.

VALVE GEAR.—One hardened steel inlet-valve and one heat-resisting austenitic exhaust-valve per cylinder, each operated through rocker-arm, ball-ended push-rod and Wilcox-Rich hydraulic tappet, all sealed to prevent external oil leakage. Cast Preferall camshaft has six hardened cams (intake cams are common to opposing cylinders). Three hardened journals and overhung eccentric at airscrew end to run fuel pump.

INDUCTION SYSTEM.—Single up-draught Stromberg NA-S3A1 carburettor supplies mixture to cast-aluminium X-manifold with exhaust-heated hot-spot. Steel intake pipes connect manifold to intake ports.

IGNITION.—Dual magnetos either Eisemann LA-4, Case 4-CAM-E or Scintilla S4-RN-20.

LUBRICATION.—Oil at 30 lb./sq. in. (2.11 kg./cm.^{2}) passes through oil tubes in crankshaft to crank-pins and also passes through tappet, push-rod and rocker-arm to rocker-arm bushing and valve-tip. Valve-stem and guide lubricated by splash. Oil returned to crankcase by way of push-rod housings. Pressure filter and relief-valve in crankcase.

AIRSCREW DRIVE.—R.H. tractor. Direct. No. 0 S.A.E. taper.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE CONTINENTAL C85 SERIES.

The C85 Series is identical to the earlier C75 Series except that the C85 carburettor has a $1\frac{3}{8}$ in. (35 mm.) venturi as compared with $1\frac{5}{16}$ in. (33.2 mm.) for the C75 and larger main metering jet. The normal rated r.p.m. of the C85 is increased from 2,275 to 2,575 and the cruising r.p.m. from 2,125 to 2,400. The rated output is increased from 75 to 85 h.p.

The Series 8 engine has a tapered crankshaft while the sub-type 8F has a flanged shaft. The Series 12 has the addition of starter and generator drives in the accessory case.

General constructional details are similar to those of the A65 Series. For other details see Table.

THE CONTINENTAL C90 SERIES.

The C90 Series includes the C90-8F which has a flanged crankshaft but does not have provisions for installing either a starter or generator, and the C90-12F which has a flanged crankshaft and Delco-Remy starter and generator.

This Series differs from the C85 Series in having cylinders with a slightly larger bore. Otherwise the two engines are constructionally the same. The C90 Series engines have an approved take-off rating of 95 h.p. at 2,625 r.p.m. For other details see Table.

THE CONTINENTAL O-300-A and B.

The O-300 is a six-cylinder engine which uses the cylinders of the C90 Series. Equipment includes a Marvel MA-3SPA carburettor and Scintilla S6LN-21 magneto. General constructional details are otherwise similar to those of the C90 Series.

Both A and B Series engines are identical except that there is provision for a controllable airscrew in the latter.

THE CONTINENTAL GO-315-A.

The GO-315-A is a four-cylinder geared engine which makes use of the larger 5×4 in. cylinders of O-470 Series. The airscrew gear ratio is .688 : 1. This engine has a take-off output of 175 h.p. at 3,200 crankshaft r.p.m.

THE CONTINENTAL O-470 SERIES.

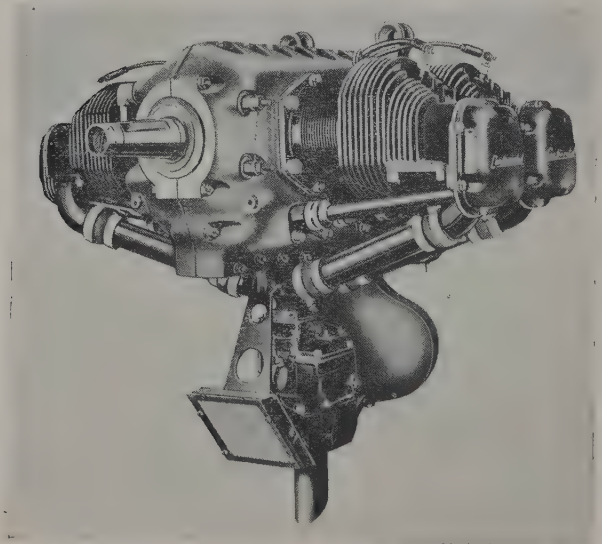
Engines in the O-470 series are all basically similar. Following are the main differences in the various versions in current use :—

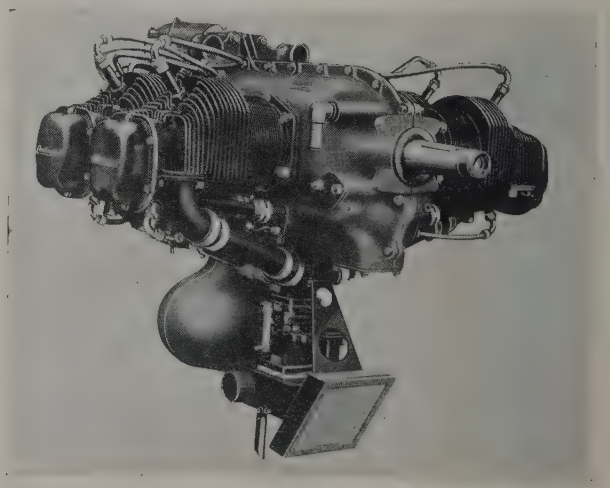
O-470-B. As detailed description below, but with inclined valves and 8 : 1 compression ratio. One Bendix-Stromberg PSD-5C updraught carburettor at rear of engine. Develops 240 h.p. at 2,600 r.p.m. for take-off and maximum continuous cruise. 91/96 octane fuel. Weight 450 lb. (204 kg.).

O-470-E. As detailed description below, but one Bendix-Stromberg PSD-5C updraught carburettor. Develops 225 h.p. at 2,600 r.p.m. Weight 390 lb. (177 kg.).

O-470-G. As detailed description below, but with shell moulded cylinder heads, different mounting and Bendix-Stromberg PSH-5BD automatic altitude-compensating updraught carburettor. Develops 240 h.p. at 2,600 r.p.m. 91/96 octane fuel. Weight 466.5 lb. (211 kg.).

O-470-H. As detailed description below, but with shell moulded cylinder heads, different mounting and extended airscrew shaft. Develops 240 h.p. at 2,600 r.p.m. 91/96 octane fuel. Weight 510 lb. (231 kg.).





Above—The 85 h.p. Continental C85 Series engine.

Left—The 65 h.p. Continental A65 Series engine.

O-470-J. As detailed description below. Develops 225 h.p. at 2,550 r.p.m. Weight 415 lb. (188 kg.).

O-470-K. Description below refers to this model.

O-470-L. As detailed description below, but with updraught carburettor mounted at rear of engine.

O-470-M. As detailed description below, but with shell moulded cylinder heads and different mounting. Develops 240 h.p. at 2,600 r.p.m. 91/96 octane fuel. Weight 450 lb. (204 kg.).

The following description refers specifically to the O-470-K, but is generally applicable to all versions :—

TYPE.—Six-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 5 in. (127 mm.). Stroke 4 in. (101.6 mm.). Swept volume 471 cub. in. (7.5 litres). Compression ratio 7 : 1. Forged steel barrels with integral cooling fins. Heat-treated cast aluminium alloy heads screwed and shrunk on to barrels.

PISTONS.—Aluminium. Three rings, two compression and one oil control. Steel gudgeon-pins with circlip retainers.

CONNECTING RODS.—Forged steel. Trimetal bronze replaceable type big-end bearings bronze bush little-ends.

CRANKSHAFT.—One-piece six-throw chrome-nickel-molybdenum steel forging. Outer surfaces nitrided. Counterweights attached to rear end of shaft. Five bearings of replaceable shell type.

CRANKCASE.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft, with integral cast accessory section.

VALVE GEAR.—Two poppet-type valves per cylinder, one steel inlet and one steel exhaust with stellite seat. Camshaft gear-driven from crankshaft in lower part of crankcase.

INDUCTION. — Marvel Schebler MA-4-5 horizontal pressure-type carburettor.

FUEL.—80 Octane.

IGNITION.—Two Scintilla Type S6RN-25 magnetos on top of accessory section. Two Champion C27-S short-reach sparkplugs per cylinder. Shielded ignition harness.

LUBRICATION. — Pressure type. Harrison oil-cooler on front of crankcase. Oil filter in crankcase. One impeller type pump. Oil pressure 30-60 lb./sq. in. (2.1-4.2 kg./cm.²).

AIRSCREW DRIVE.—R.H. drive. Direct. Special flanged airscrew shaft. Provision for Hartzell constant-speed airscrew.

ACCESSORIES.—Delco-Remy generator on accessory section. Drives for vacuum pump and tachometer.

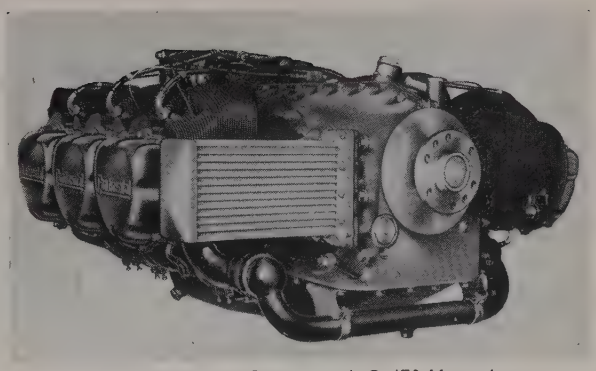
STARTING.—Delco-Remy electric starter.

MOUNTING.—Four mounting points, one at each lower corner of crankcase.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE CONTINENTAL O-470-2.

The O-470-2 is a supercharged version of the O-470. It is fitted with a belt-driven centrifugal blower with a ratio of 10.36 : 1 and a Bendix-Stromberg PSH-5CD horizontal pressure carburettor.



The 240 h.p. Continental O-470-M engine.

In most other respects the engine is similar to the O-470-K.

THE CONTINENTAL GSO-526-A.

The GSO-526-A is a geared and supercharged six-cylinder engine which is basically and constructionally similar to the O-470 Series but has larger cylinders of 5.125 in. (130 mm.) bore and 4.25 in. (108 mm.) stroke. For further details see Table.

THE CONTINENTAL FSO-526-A.

The FSO-526-A is arranged for helicopter use. It is fitted with fan-cooling, with a single shrouded gear-driven fan driven off the front end of the crankshaft and serving both rows of cylinders. For other details see table.

THE CONTINENTAL HORIZONTALLY-OPPOSED ENGINES

Engine Model	No. of Cylinders	Bore and Stroke	Swept Volume	Power Ratings			Comp. Ratio	Dry Weight	Dimensions			Fuel Grade
				Take-off	Normal	Cruise			Length	Width	Height	
A65-8	4	3⅞ × 3⅝ in. (98.4 × 92 mm.)	171 cub. in. (2.80 litres)	65 h.p. at 2,350 r.p.m.	65 h.p. at 2,350 r.p.m.	53 h.p. at 2,150 r.p.m.	6.3 : 1	176 lb. (79.9 kg.)	31 in. (787 mm.)	31.5 in. (800 mm.)	—	80/87 Octane
C85-12F	4	4 1/16 × 3⅝ in. (103.2 × 92 mm.)	188 cub. in. (3.08 litres)	85 h.p. at 2,575 r.p.m.	85 h.p. at 2,575 r.p.m.	63 h.p. at 2,400 r.p.m.	6.3 : 1	182 lb. (82.6 kg.)	32 in. (813 mm.)	31.6 in. (804 mm.)	—	80/87 Octane
C90-12F	4	4 1/16 × 3⅞ in. (103.2 × 98.4 mm.)	201 cub. in. (3.28 litres)	95 h.p. at 2,625 r.p.m.	90 h.p. at 2,475 r.p.m.	68 h.p. at 2,350 r.p.m.	7.0 : 1	186 lb. (84.4 kg.)	32 in. (813 mm.)	31.6 in. (804 mm.)	—	80/87 Octane
O-300-A and -B	6	4 1/16 × 3⅞ in. (103.2 × 98.4 mm.)	301 cub. in. (4.9 litres)	145 h.p. at 2,700 r.p.m.	145 h.p. at 2,700 r.p.m.	108 h.p. at 2,450 r.p.m.	7.0 : 1	265 lb. (120.3 kg.)	41 in. (1,041 mm.)	31.6 in. (804 mm.)	—	80/87 Octane
O-470-K and -L	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	230 h.p. at 2,600 r.p.m.	230 h.p. at 2,600 r.p.m.	175 h.p. at 2,400 r.p.m.	7.0 : 1	438 lb. (199 kg.)	33.03 in. (839 mm.)	33.56 in. (852 mm.)	22.75 in. (578 mm.)	80/87 Octane
O-470-M	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	240 h.p. at 2,600 r.p.m.	240 h.p. at 2,600 r.p.m.	—	8.0 : 1	450 lb. (204 kg.)	43.3 in. (1,100 mm.)	33.3 in. (846 mm.)	19.6 in. (498 mm.)	91/96 Octane
O-470-2	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	265 h.p. at 2,600 r.p.m.	250 h.p. at 2,600 r.p.m.	190 h.p. at 2,400 r.p.m.	7.0 : 1	474 lb. (214 kg.)	37.7 in. (960 mm.)	33.6 in. (855 mm.)	30.7 in. (780 mm.)	100/130 Grade
O-470-11	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	213 h.p. at 2,600 r.p.m.	190 h.p. at 2,300 r.p.m.	—	7.0 : 1	395 lb. (180 kg.)	45.2 in. (1,150 mm.)	33.4 in. (850 mm.)	30.1 in. (765 mm.)	80 Octane
O-470-13A	6	5 × 4 in. (127 × 101.6 mm.)	471 cub. in. (7.6 litres)	225 h.p. at 2,600 r.p.m.	225 h.p. at 2,600 r.p.m.	175 h.p. at 2,400 r.p.m.	7.0 : 1	415 lb. (188 kg.)	45.2 in. (1,150 mm.)	33.4 in. (850 mm.)	30.1 in. (765 mm.)	80 Octane
GSO-526-A	6	5.125 × 4.25 in. (130 × 108 mm.)	526 cub. in. (8.64 litres)	320 h.p. at 3,000 r.p.m.	290 h.p. at 3,000 r.p.m.	220 h.p. at 2,700 r.p.m.	6.0 : 1	540 lb. (245 kg.)	52.8 in. (1,340 mm.)	36 in. (915 mm.)	23.9 in. (610 mm.)	91/96 Octane
FSO-526-A (Helicopter)	6	5.125 × 4.25 in. (130 × 108 mm.)	526 cub. in. (8.64 litres)	260 h.p. at 3,000 r.p.m.	260 h.p. at 3,000 r.p.m.	—	6.0 : 1	568 lb. (258 kg.)	47.69 in. (1,221 mm.)	33.64 in. (855 mm.)	24.73 in. (628 mm.)	91/96 Octane

FRANKLIN

AIRCOOLED MOTORS, INC.

HEAD OFFICE AND WORKS: SYRACUSE 8, N.Y.

President and General Manager: C. F. B. Roth.

Sales Manager: C. H. Bennum.

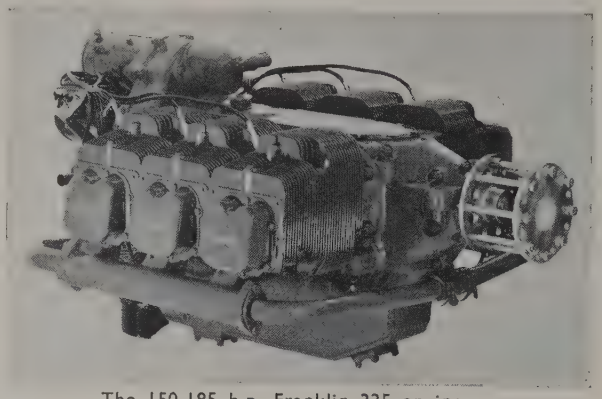
Service Manager: W. I. Marble.

Chief Engineer: J. D. Cregan.

Aircooled Motors, Inc. produced the first of its very successful series of light horizontally-opposed air-cooled engines in 1938. Up to the outbreak of war it had placed on the market engines of four and six cylinders ranging in output from 65 to 150 h.p.

Aircooled Motors, Inc. has been very active in the development of self-cooled aircraft engines both for helicopter and conventional installations. A cooling-fan is incorporated on some models as an integral part of the engine and together with air housings will permit a totally-submerged engine installation in either the vertical or horizontal position.

The current series of Franklin engines comprises a number of six-cylinder models covering a range of from 150 to 300 h.p.



The 150-185 h.p. Franklin 335 engine.

FRANKLIN AIRCOOLED ENGINES.

TYPE.—Six-cylinder, horizontally-opposed direct-drive air-cooled.

CYLINDERS.—One-piece aluminium-alloy with removable iron liner. Attached to crankcase by integral hold-down flange and studs and nuts.

PISTONS.—Trunk-type, aluminium-alloy permanent-mould. Two compression and one oil ring per piston. Fully-floating piston-pins.

CRANKSHAFT.—One-piece six-throw steel forging with SAE standard airscrew shaft flange. Main and connecting rod bearings steel-backed and copper-lead faced.

CRANKCASE.—Aluminium-alloy in two halves split vertically. Detachable wet oil-sump underneath.

VALVE GEAR.—One overhead inlet and overhead exhaust valve per cylinder actuated by push-rods through rocker-arms with adjustable tappets. Wilcox-Rich hydraulic valve lifters provide zero-clearance regardless of engine temperature. Valve-gear totally enclosed and internally lubricated.

CARBURATION.—Marvel-Schebler float-type carburettor with altitude-control and idle cut-off, or Bendix-Stromberg pressure-type non-icing carburettor. Not optional.

REMARKS.—Some models are entirely self-cooled by means of an integral axial-flow fan directly connected to the crankshaft. Air housings are provided which make these engines suitable for submerged installations.

THE FRANKLIN 335.

TYPE.—Six-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 4½ in. (114.3 mm.). Stroke 3½ in. (88.9 mm.). Capacity 335 cub. in. (5.5 litres). Compression ratio 7.0 : 1.

FUEL GRADE.—80 Octane.

ACCESSORIES.—Dual magnetos, float-type carburettor, 12-volt starter-generator, oil cooler. Fuel pump optional.

WEIGHTS (with starter, generator and oil-cooler).—
320 lb. (145.3 kg.).

PERFORMANCE.—
Rated output: 150 h.p. at 2,600 r.p.m.
(6A4-150-B3), 165 h.p. at 2,800 r.p.m.
(6A4-165-B3), 185 h.p. at 3,100 r.p.m.
(6AG4-185-B12 with .632 : 1 reduction gear).

THE FRANKLIN 335 VERTICAL

TYPE.—Six-cylinder horizontally-opposed air-cooled. Engine operates in vertical position and is designed especially for a helicopter installation.

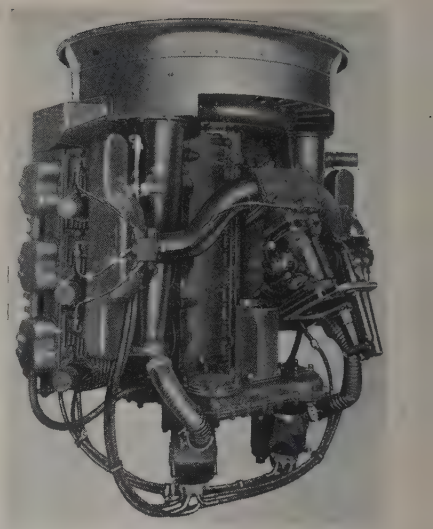
ACCESSORIES.—Dual magnetos, float or pressure-type carburettor, 12-volt starter, generator, fuel-pump, oil-cooler.

WEIGHT.—
310 lb. (140.7 kg.).

PERFORMANCE.—
Nett rated output: 178 h.p. at 3,000 r.p.m. (6V4-178-B32 and B33) without fan, or 200 h.p. at 3,100 r.p.m. (6V4-200-C32 and C33) using 90/91 octane fuel.

THE FRANKLIN 425.

Basic version of the Franklin 425 is the Model 6V6-245, which is widely used as a vertically-mounted helicopter power plant. The U.S. services have sponsored



The 300 h.p Franklin 425 helicopter engine.

two supercharged developments, of which the O-425-2 has a Rootes positive-displacement supercharger and the O-425-13 (6V6-300-D16FT) a turbo-supercharger of Franklin design. Tethered tests of the O-425-13 have been made in a Sikorsky S-52 helicopter.

TYPE.—Six-cylinder horizontally-opposed air-cooled. Designed specially for helicopter installation and operates in vertical position. Equipped with axial-flow cooling fan and air housing. The 6V6-300-D16FT is fitted with supercharger.

CYLINDERS.—Bore 4¾ in. (120.6 mm.). Stroke 4 in. (101.6 mm.). Displacement 425 cub. in. (6.8 litres). Compression ratio 7.5 : 1.

FUEL GRADE.—80 Octane (6V6-245-B16F) or 100/130 Grade (6V6-300-D16FT).

DIMENSIONS.—
Width overall 33⅜ in. (845 mm.).
Height overall 38 in. (965 mm.).
Length overall 39⅜ in. (996 mm.).

WEIGHT DRY.—
352 lb. (160 kg.) (6V6-245-B16F), 397 lb. (180 kg.) (6V6-300-D16FT) with cooling system, ignition system, carburettor, priming system and accessory drive covers.

PERFORMANCE (6V6-245-B16F).—
Max. power for take-off 245 h.p. at 3,275 r.p.m.

PERFORMANCE (6V6-300-D16FT commercial).—
Max. power for take-off 300 h.p. at 3,275 r.p.m.
Normal power 285 h.p. at 3,275 r.p.m.

CONSUMPTIONS (6V6-245-B16F).—
Fuel (cruising) .52 lb. (.236 kg.) per h.p./hr.
Oil .02 lb. (.009 kg.) per h.p./hr.

CONSUMPTIONS (6V6-300-D16FT).—
Fuel 0.43 lb. (.195 kg.) per h.p./hr.
Oil 0.02 lb. (.009 kg.) per h.p./hr.

LYCOMING

THE LYCOMING DIVISION OF THE AVCO MANUFACTURING CORPORATION.

HEAD OFFICE: 550, SOUTH MAIN STREET, STRATFORD, CONNECTICUT.

WORKS: STRATFORD, CONN., AND WILLIAMSPORT, PENNSYLVANIA.

President and General Manager: James R. Kerr.

Vice-President, Engineering: Arthur Nutt.

Vice-President, Turbine Engineering: Dr. Anselm Franz.

Vice-President, Industrial Relations: James E. Mitchell.

Vice-President, Manager, Stratford Plant: Donald F. Turner.

Vice-President, Manager, Williamsport Plant: Floyd J. Bird.

Controller: C. J. Mason.

The Lycoming Division is the manufacturing division of the AVCO Manufacturing Corporation.

The Division is licenced by the Wright Aeronautical Division of the Curtiss-Wright Corporation to manufacture the R-1300 and R-1820 Series seven and nine-cylinder radial air-cooled engines in nine models at its Stratford plant.

It also manufacturers at its Williamsport plant the Lycoming series of horizontally-opposed air-cooled engines in eight basic models, five four-cylinder, two six-cylinder and one eight-cylinder.

Lycoming is also developing the T53 and T55 shaft-drive turbines under U.S.A.F./U.S. Army contracts. Details of these engines will be found in Part I of this Section.

THE LYCOMING O-235 and O-290 SERIES.

The version of the O-290 Series engine in current production is the O-290-D2B, which differs from the preceding O-290-D2 by a compression ratio reduction from 7.50 to 7.00 : 1 and increased spark advance from 18° BTC to 25° BTC.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore O-235-C 4⅛ in. (111 mm.). O-290-D 4⅞ in. (123.7 mm.). Stroke (both) 3⅞ in. (98.4 mm.). Aluminium-alloy head screwed and shrunk onto steel barrel. Cylinder assemblies attached to crankcase by studs and nuts.

PISTONS.—Machined from aluminium-alloy forgings. O-235 piston has four rings, two compression, an oil regulator and an oil scraper. O-290 has three rings, two compression and one oil regulating. Fully-floating gudgeon-pins with aluminium-alloy retaining plugs.

CONNECTING RODS.—Forged steel. Copper-lead steel-backed precision type bearings. Bronze bushed little-ends.

CRANKSHAFT.—One-piece forged chrome nickel molybdenum steel four-throw shaft on four nitrided bearings.

CRANKCASE.—Aluminium-alloy casting split on vertical centre-line. Four precision copper-lead steel-backed main bearings.

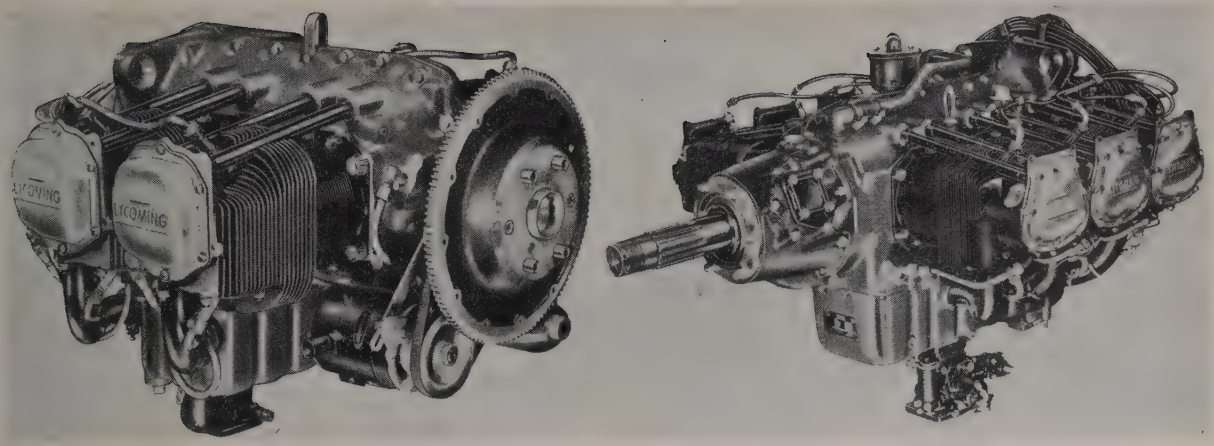
VALVE GEAR.—Two valves per cylinder. Inlet valves of Silchrome No. 1, exhaust valves of AMS 5682 with Stellite-faced heads. Valve seats of AMS 5700 shrunk into head.

INDUCTION.—Marvel-Schebler MA-3A carburettor with manual altitude control and idle cut-off. Centre zone distribution chamber in oil sump.

IGNITION.—Two Bendix Scintilla S4LN magnetos, one driven through an impulse coupling.

LUBRICATION.—Full pressure wet sump type.

ACCESSORIES.—Starter, generator and tachometer drive. Starter is a Delco-Remy 12-



On the left, the 150 h.p. Lycoming O-320 and, on the right, the 260 h.p. Lycoming GO-435-B engines.

volt automotive type located at front and cranks engine through a Bendix drive which engages with a gear integral with rear airscrew flange. Delco-Remy 12-volt automotive generator also at front of engine and driven by belt and pulley. Optional drives for fuel pump and vacuum pump can be supplied. Pads for these optional drives mounted on rear of engine.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING O-320.

The O-320 is basically the same as the O-290-D2B except for an increase in cylinder bore to $5\frac{1}{8}$ in. (130 mm.) with a corresponding increase in swept volume to 319.8 cub. in. (5.2 litres), and use of a Marvel-Schebler MA-4SPA carburettor. For other details see Table.

THE LYCOMING O-340 and O-360 SERIES.

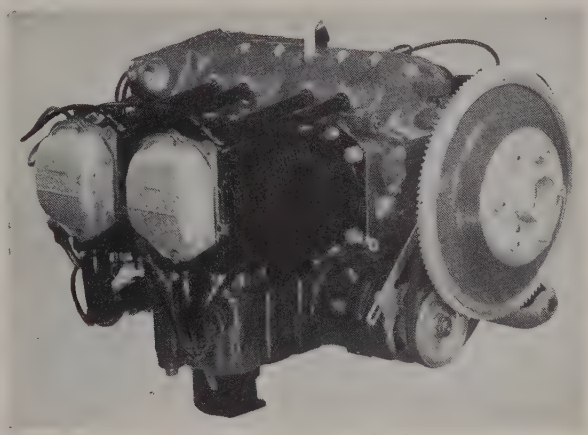
The O-340 is basically the same as the O-320 except for an increase in stroke to $4\frac{1}{8}$ in. (105 mm.) with a corresponding increase in swept volume to 340.4 cub. in. (5.58 litres), and use of the larger Marvel-Schebler MA-4-5 carburettor. The O-360, which has the highest rating of any four-cylinder engine certificated for production in America, is the same as the O-340 except for a further increase in stroke to $4\frac{3}{8}$ in (111 mm.), with a corresponding increase in swept volume to 361 cub. in. (5.92 litres). Both engines are available in low and high compression versions for use with 80/87 or 91/96 octane fuels respectively. For other details see Table.

THE LYCOMING O-435 SERIES.

The O-435 Series includes direct-drive, geared and geared and supercharged models, details of which will be found in the Table. The O-435-KI is a direct-drive engine for horizontal helicopter installation while the VO-435-A1B is a helicopter engine for vertical installation. The GO-435-C2B is a geared-drive wet sump engine with an airscrew governor drive mounted on the left side of the airscrew reduction-gear housing. The GO-435-C2A is similar to the GO-435-C2B but provides dry sump operation for use with an external oil supply.

TYPE.—Six-cylinder horizontally-opposed air-cooled incorporating the major components of O-290.

CYLINDERS.—Bore $4\frac{7}{8}$ in. (123.7 mm.). Stroke $3\frac{7}{8}$ in. (98.4 mm.).



The Lycoming O-235 and O-290 Series engine.

PISTONS.—Aluminium-alloy pistons with two compression and two oil control rings.

CONNECTING RODS.—H-section steel forgings with replaceable bearing inserts in big-ends and split bronze bushings in little-ends.

CRANKSHAFT.—Machined from chrome nickel molybdenum steel forging. All bearing surfaces nitrided.

CRANKCASE.—Aluminium-alloy casting split on the vertical centre-line. Additional ball-thrust bearing at forward end of case.

INDUCTION.—Marvel-Schebler MA-4-5 single barrel carburettor attached to bottom of oil sump casting. The distributing zone is submerged in oil. Separate induction pipes lead to inlet valves.

IGNITION.—Two Bendix-Scintilla magnetos driven by spur gears from the timing gear.

LUBRICATION.—Full pressure type, including valve mechanism. Crankshaft equipped with centrifugal sludge-removers. Pistons, gudgeon-pins and accessory drive gears lubricated by splash.

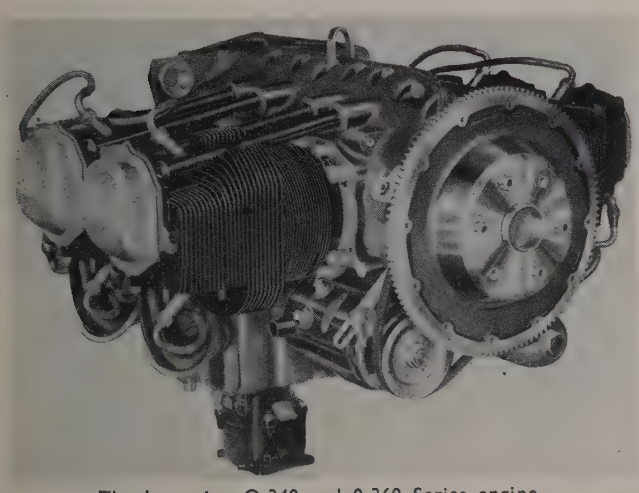
ACCESSORY HOUSING.—Aluminium-alloy casting bolted to rear of crankcase and top rear of oil sump. Houses oil pump and geared accessory drives, and provides mounting for starter and generator, fuel pump, tachometer drive and magnetos. Vacuum pump drive optional equipment.

STARTING.—Delco-Remy 12-volt automotive type starter. Starter torque applied to crankshaft gear through Bendix-type starter drive.

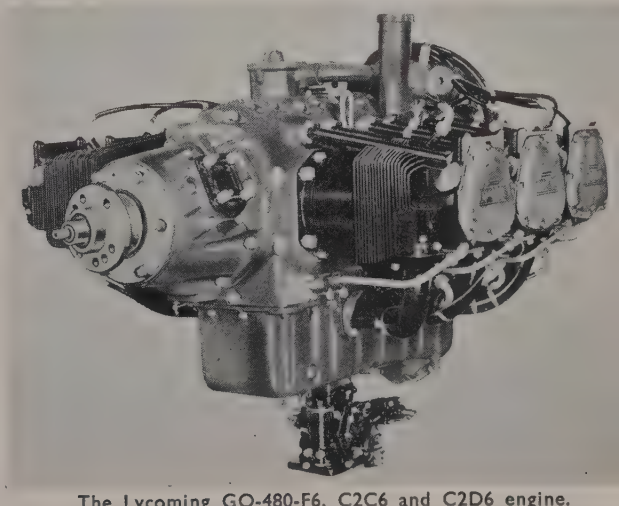
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING O-480 SERIES.

The O-480 Series is basically the same as the O-435 except for an increase in cylinder bore to $5\frac{1}{8}$ in. (130 mm.). The GSO-480-A1A6 (military designation O-480-1) has a supercharger drive ratio of 11.27 : 1, which provides rated power to an altitude of 8,000 ft. (2,440 m.). For other details see Table.



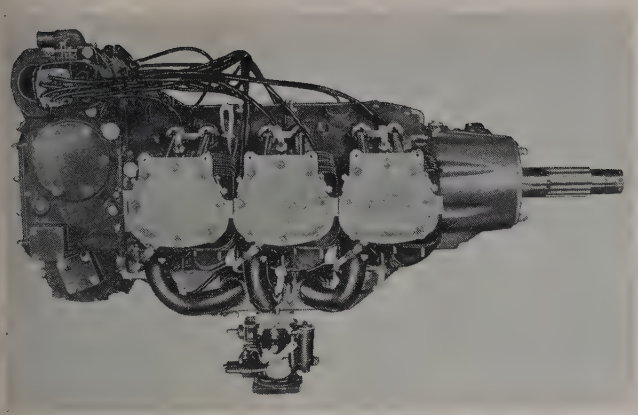
The Lycoming O-340 and 0-360 Series engine.

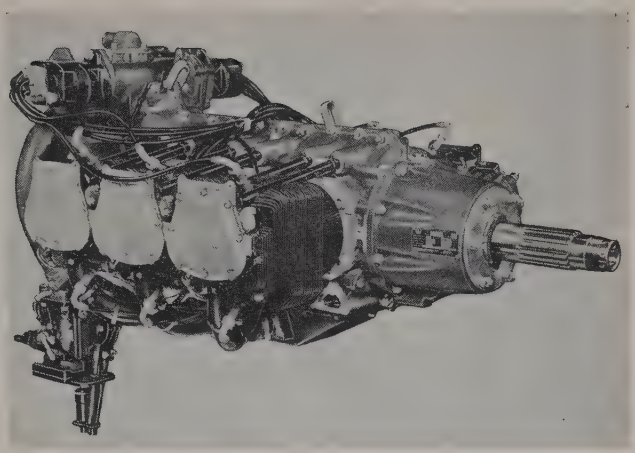


The Lycoming GO-480-F6, C2C6 and C2D6 engine.

LYCOMING HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Rated output at Sea level	Capacity	Compression Ratio	Octane No.	Weight Dry	Overall Length	Overall Width	Overall Height	Gear Ratio
O-235-C1	4	108 h.p. at 2,600 r.p.m. (T.O. 115 h.p. at 2,800 r.p.m.)	233 cub. in. (3.85 litres)	6.75 : 1	80/87	235 lb. (106.6 kg.)	29.56 in. (751 mm.)	32.00 in. (812 mm.)	22.53 in. (570 mm.)	Direct
O-290-D2B	4	135 h.p. at 2,600 r.p.m. (T.O. 140 h.p. at 2,800 r.p.m.)	289 cub. in. (4.75 litres)	7.0 : 1	80/87	260 lb. (118 kg.)	29.56 in. (751 mm.)	32.24 in. (819 mm.)	22.81 in. (579 mm.)	Direct
O-320	4	150 h.p. at 2,700 r.p.m.	319.8 cub. in. (5.2 litres)	7.0 : 1	80/87	272 lb. (123.4 kg.)	29.56 in. (751 mm.)	32.24 in. (819 mm.)	23.12 in. (587.2 mm.)	Direct
O-340-A1A	4	170 h.p. at 2,700 r.p.m.	340.4 cub. in. (5.58 litres)	8.5 : 1	91/96	278 lb. (126.1 kg.)	29.56 in. (751 mm.)	32.55 in. (827 mm.)	24.68 in. (627 mm.)	Direct
O-340-B1A	4	160 h.p. at 2,700 r.p.m.	340.4 cub. in. (5.58 litres)	7.5 : 1	80/87	275 lb. (124.7 kg.)	29.56 in. (751 mm.)	32.55 in. (827 mm.)	24.68 in. (627 mm.)	Direct
O-360-A1A	4	180 h.p. at 2,700 r.p.m.	361 cub. in. (5.92 litres)	8.5 : 1	91/96	282 lb. (127.9 kg.)	29.56 in. (751 mm.)	33.37 in. (848 mm.)	24.68 in. (627 mm.)	Direct
O-360-B1A	4	168 h.p. at 2,700 r.p.m.	361 cub. in. (5.92 litres)	7.2 : 1	80/87	280 lb. (127 kg.)	29.56 in. (751 mm.)	33.37 in. (848 mm.)	24.68 in. (627 mm.)	Direct
O-435-A	6	190 h.p. at 2,550 r.p.m.	434 cub. in. (7.1 litres)	6.5 1	80/87	392 lb. (177.9 kg.)	38.10 in. (967 mm.)	32.24 in. (819 mm.)	29.59 in. (751 mm.)	Direct
GO-435-C2A	6	240 h.p. at 3,000 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	428 lb. (194 kg.)	40.59 in. (1,031 mm.)	33.12 in. (842 mm.)	25.52 in. (648 mm.)	.642 : 1
GO-435-C2B	6	240 h.p. at 3,000 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	430 lb. (195 kg.)	40.59 in. (1,031 mm.)	33.12 in. (842 mm.)	29.40 in. (747 mm.)	.642 : 1
VO-435-A1B	6	250 h.p. at 3,200 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	391 lb. (177.4 kg.)	—	—	—	Direct. For vertical mounting
GO-480-B1B	6	260 h.p. at 3,000 r.p.m. (T.O. 270 h.p. at 3,400 r.p.m.)	479.7 cub. in. (7.8 litres)	7.3 : 1	80/87	436 lb. (197.8 kg.)	38.64 in. (981 mm.)	33.12 in. (842 mm.)	28.02 in. (712 mm.)	.642 : 1
GO-480-C1B6	6	280 h.p. at 3,000 r.p.m. (T.O. 295 h.p. at 3,400 r.p.m.)	479.7 cub. in. (7.8 litres)	8.7 : 1	100/130	464 lb. (211.1 kg.)	40.04 in. (1,017 mm.)	33.12 in. (842 mm.)	27.46 in. (687 mm.)	.642 : 1
GO-480-C2C6	6	285 h.p. at 3,100 r.p.m. (T.O. 295 h.p. at 3,400 r.p.m.)	479.7 cub. in. (7.8 litres)	8.7 : 1	100/130	448 lb. (204 kg.)	42.18 in. (1,072 mm.)	33.12 in. (842 mm.)	28.02 in. (712 mm.)	.642 : 1
GO-480-D1A	6	260 h.p. at 3,000 r.p.m. (T.O. 275 h.p. at 3,400 r.p.m.)	479.7 cub. in. (7.8 litres)	7.3 : 1	80/87	454 lb. (205.9 kg.)	40.04 in. (1,017 mm.)	33.12 in. (842 mm.)	27.46 in. (687 mm.)	.642 : 1
GO-480-F6	6	265 h.p. at 3,100 r.p.m. (T.O. 275 h.p. at 3,400 r.p.m.)	479.7 cub. in. (7.8 litres)	7.3 : 1	80/87	442 lb. (200.5 kg.)	42.18 in. (1,072 mm.)	33.12 in. (842 mm.)	28.02 in. (712 mm.)	.642 : 1
GSO-480-A1A6 (O-480-1 military)	6	320 h.p. at 3,200 r.p.m. (T.O. 340 h.p. at 3,400 r.p.m.)	479.7 cub. in. (7.8 litres)	7.3 : 1	80/87	492 lb. (223.3 kg.)	46.22 in. (1,174 mm.)	33.12 in. (842 mm.)	33.08 in. (840 mm.)	.642 : 1
SO-480	6	325 h.p. at 3,200 r.p.m.	479.7 cub. in. (7.8 litres)	7.3 : 1	100/130	444 lb. (201.4 kg.)	38.53 in. (979 mm.)	33.12 in. (842 mm.)	22.73 in. (578 mm.)	Direct
GSO-580-C	8	320 h.p. at 3,000 r.p.m. (T.O. 375 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	91/96	560 lb. (254.2 kg.)	49.20 in. (1,250 mm.)	33.18 in. (843 mm.)	34.22 in. (869 mm.)	.642 : 1
SO-580-A1A	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	578 lb. (262.2 kg.)	46.62 in. (1,184 mm.)	33.12 in. (842 mm.)	24.49 in. (622 mm.)	.642 : 1
GSO-580-D (O-580-1 military)	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	610 lb. (276.7 kg.)	56.86 in. (1,444 mm.)	33.18 in. (843 mm.)	34.22 in. (869 mm.)	.642 : 1
VSO-580-A1A (O-580-3 military)	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	591 lb. (268.1 kg.)	—	—	—	Direct. For vertical mounting





Above, the Lycoming GO-480-D1A and C1B6 engine.
On the right, the Lycoming GSO-480-A1A6 supercharged engine.

THE LYCOMING GSO-580 SERIES.

Current GSO-580 Series engines are the GSO-580-C and GSO-580-D (Military designation O-580-1). Details of both these engines will be found in the Table. The GSO-580-C is identical to the GSO-580-D except that it is rated on 91/96 Grade fuel at 375 h.p. at 3,300 r.p.m. for take-off and 320 h.p. at 3,000 r.p.m. maximum continuous.

Model SO-580-A1A is the same as the GSO-580-D less the reduction gear, for horizontal helicopter installation. The VSO-580-A1A is the same but suitable for vertical installation.

TYPE.—Eight-cylinder horizontally-opposed air-cooled, geared and supercharged.

CYLINDERS.—Bore $4\frac{7}{8}$ in. (123.7 mm.). Stroke $3\frac{7}{8}$ in. (98.4 mm.). Displacement 578 cub. in. (10.4 litres). Compression ratio 7.30 :1. Aluminium-alloy heads, with 50% increase in fin area over previous Lycoming head design, screwed and shrunk onto steel barrels. Cylinder assemblies attached to crankcase by studs and nuts.

PISTONS.—Forged aluminium pistons with three rings above gudgeon-pin and one below. Top ring is a compression ring, wedge type, chrome plated. Second ring, also compression type, is cast iron wedge type. Third ring is an oil regulating ring. Fourth ring is an oil scraper below fully-floating gudgeon-pin.

CONNECTING RODS.—H-section alloy steel. Fitted with replaceable inserts at crank-pin journals and bronze bushings at piston-pin ends.

CRANKCASE.—Two machined aluminium-alloy castings joined on vertical centre-line by through bolts and studs.

CRANKSHAFT.—Eight-throw chrome nickel molybdenum shaft on five main bearings. Fitted with four pairs of dynamic dampers tuned to crankshaft torsional period to eliminate fourth order torsional vibration.

REDUCTION GEAR.—Planetary type, 77 : 120 ratio.

AIRSCREW GOVERNOR DRIVE.—AND-20010 airscrew governor drive on reduction-gear housing, permitting use of a hydraulically-controlled constant-speed airscrew.

CARBURATION.—Pressure-type Bendix carburettor Model PS-9BDE with altitude control and solenoid primer.

SUPERCHARGER.—Centrifugal type supercharger with a single outlet directly connected to central distributing zone with four Y-type intake pipes connecting distributing zone to cylinders. Ratio 7.9 : 1.

IGNITION.—Two Scintilla S4RN-21 magnetos.

LUBRICATION.—Full-pressure dry sump.

ACCESSORIES.—Pads for mounting starter, generator, fuel pump, hydraulic pump, vacuum pump and tachometer. All accessories are side-mounted for ease of servicing.

DIMENSIONS. WEIGHTS AND PERFORMANCE.—See Table.

McCULLOCH

McCULLOCH MOTORS CORPORATION.

HEAD OFFICE AND MAIN PLANT : 6101, WEST CENTURY BLVD., LOS ANGELES 45, CALIFORNIA.

President : Robert P. McCulloch.
Chairman : Joseph L. Hegener.
Executive Vice-President : S. H. Egbert.
Vice-President, Engineering : Gerald C. Robechaud.
Advanced Development : John L. Ryde.
Vice-President, Sales : C. F. Breer.
Secretary and Assistant Treasurer : J. D. Cavanaugh.

McCulloch Motors Corpn. produces a variety of gasoline-engine products, making extensive use of high-pressure die casting of aluminium and magnesium.

Since 1943 the company has been producing engines for use in radio-controlled target aircraft and helicopters. The latest of these are described below.

THE McCULLOCH MODEL 4318A.
Military designation: O-100-1.

TYPE. — Four-cylinder horizontally-opposed air-cooled two-stroke.

CYLINDERS.—Bore $3\frac{3}{16}$ in. (80.8 mm.). Stroke $3\frac{1}{8}$ in. (79.4 mm.). Displacement 100 cub. in. (1.6 litres). Compression ratio 7.8 : 1. Heat-treated die-cast aluminium cylinders with integral heads, having hard chrome plated cylinder walls. Self-locking nuts secure cylinders to crankcase studs.

PISTONS.—Heat-treated cast aluminium. Two rings above pins. Piston pins of case-hardened steel.

CONNECTING RODS.—Forged steel. Split big-end carries bearing rollers in heat-treated beryllium copper cages. Small-end carries two needle bearings.

CRANKSHAFT.—Four-throw one-piece steel forging on four anti-friction bearings, two ball and two needle, one with split race for centre main bearing.

CRANKCASE.—One-piece heat-treated permanent-mould aluminium casting closed at rear end with cast aluminium cover which provides mounting for magneto.

VALVE GEAR.—Fuel mixture for scavenging and power stroke introduced to cylinders through crankshaft-driven rotary valves and ported cylinders.

INDUCTION.—Crankcase pumping type. McCulloch diaphragm-type carburettor with adjustable jet.

FUEL SPECIFICATION.—Mil-F-5572 Grade 115/145 aviation fuel.

IGNITION.—McCulloch single magneto and distributor. Directly connected to crankshaft through impulse coupling for easy starting. Radio noise suppressor included. BG type RB-936S spark plugs. Complete radio shielding.

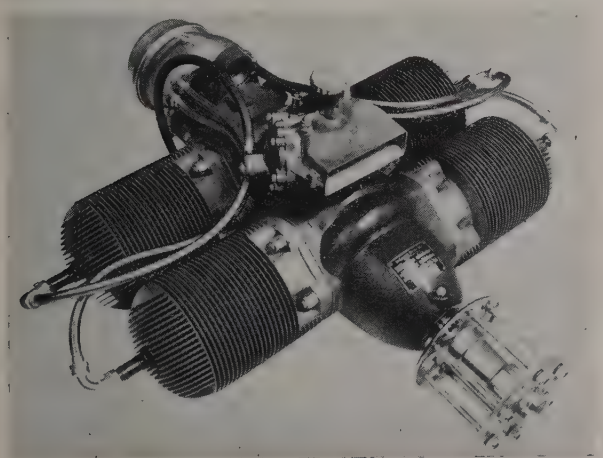
LUBRICATION.—Oil mixed with fuel as in conventional two-stroke engines.

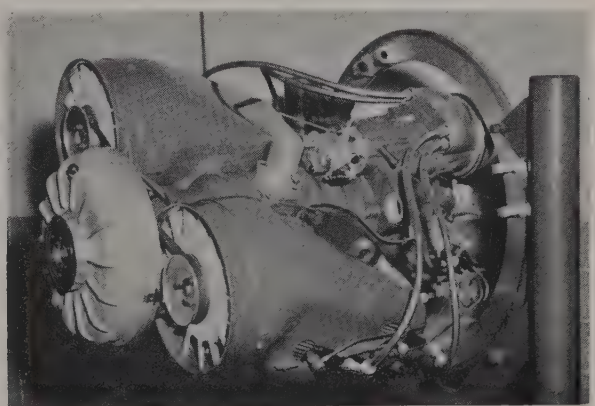
AIRSCREW DRIVE.—Direct. R.H. tractor. Keyed taper shaft.

STARTING.—By separate portable gasoline or electric motor with suitable reduction-gear and clutch.

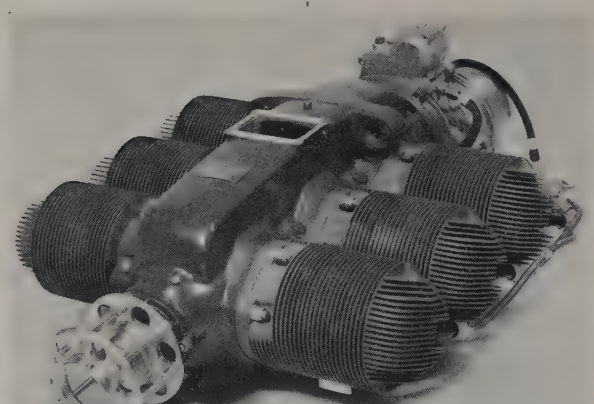
MOUNTING.—Three mounting lugs provided with sockets for rubber mounting bushings.

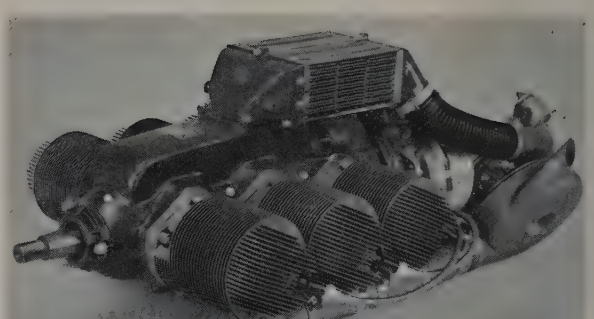
DIMENSIONS.—
Overall length 27.0 in. (68.6 cm.).
Overall width 28.0 in. (71.1 cm.).
Overall height 15.0 in. (38.1 cm.).





Above, the 60 h.p. McCulloch 4318C helicopter engine.
Left, the 72 h.p. McCulloch 4318A four-cylinder engine.





Above, the 120 h.p. McCulloch TC6150 supercharged engine.

Left, the 110 h.p. McCulloch 6318 six-cylinder engine.

WEIGHT (complete, but less airscrew hub).—77 lb. (34.9 kg.).
POWER RATING.—
Rated output 72 h.p. at 4,100 r.p.m.
CONSUMPTION.—
Fuel/oil mixture 0.90 lb./b.h.p./hr. (0.408 kg./b.h.p./hr.).

THE McCULLOCH MODEL 4318B.
Military designation: O-100-2.

The Model 4318B differs from the 4318A in that it employs the same cylinders, pistons and connecting-rods as the Model 6318 six-cylinder engine described later. The later design cylinder features a relocated sparking plug position which makes possible a reduction in the overall width of the engine by 6 in. (15.2 cm.). The newer pistons have three rings instead of two and the lateral position of the connecting-rod is controlled by thrust washers between the piston pin bosses and the corresponding end of the rod. The 4318B carburettor has a fixed jet and it incorporates a simple two-position altitude compensator for improved altitude performance.

In all other respects the two engines are the same.

DIMENSIONS.—
Same as for Model 4318A except :—
Width 22.0 in. (55.8 cm.).
WEIGHT AND PERFORMANCE.—
Same as for Model 4318A.

THE McCULLOCH MODEL 4318C.
Military designation: YO-100-4.

Intended for helicopter applications, the Model 4318C is basically similar to the Model 4318B, but features optional direct fuel injection or carburettor fuel system, can be mounted vertically and can be equipped with a fluid coupling to eliminate a manually-operated clutch and to reduce torsional vibration passed on to helicopter rotor blades.

TYPE.—Four-cylinder horizontally-opposed air-cooled two-stroke.
CYLINDERS, PISTONS, CONNECTING RODS, CRANKSHAFT, CRANKCASE, VALVE GEAR (with carburettor), IGNITION and LUBRICATION.—Same as Model 4318B, except compression ratio is 7.0 : 1.
INDUCTION.—Crankcase scavenging type. Carburettor as for Model 4318B or optional direct fuel injection.
FUEL.—Mil-F-5572 Grade 115/145 aviation fuel mixed in a ratio of 10 to 1 with oil to Mil-O-6082 Grade 1065.
EQUIPMENT (Optional). —Fluid coupling on drive end of crankshaft.
STARTING.—Automatic rewind pull-type manual starter.
MOUNTING.—Four mounting lugs provided with sockets for rubber mounting bushes.
DIMENSIONS.—
Overall length 28.0 in. (71.1 cm.).
Overall width 24.8 in. (63.0 cm.).
Overall height 15.5 in. (39.4 cm.).
WEIGHT (dry, without fluid coupling).—96 lb. (43.55 kg.).
POWER RATING.—
Rated output 60 h.p.
CONSUMPTIONS.—
Fuel 0.70 lb./b.h.p./hr. (0.32 kg./b.h.p./hr.).
Oil 0.07 lb./b.h.p./hr. (0.032 kg./b.h.p./hr.).

THE McCULLOCH MODEL 6318.
Military designation: O-150-2.

The Model 6318 differs from the 4318B in that it has six cylinders, a torsional vibration damper, a medium-pressure continuous fuel-injection system instead of a carburettor and a continuously-variable altitude compensator.

TYPE.—Six-cylinder horizontally-opposed air-cooled two-stroke.
CYLINDERS, PISTONS, CONNECTING RODS.—Same as for Model 4318B. Displacement 150 cub. in. (2.4 litres).
CRANKSHAFT.—Six-throw one piece steel forging. One ball and four needle bearings, two with split race for centre main bearings.
CRANKCASE.—One-piece heat-treated permanent-mould aluminium casting.
VALVE GEAR.—Fuel mixture for scavenging and power stroke introduced to cylinders through crankshaft-driven rotary valves and ported cylinders.
INDUCTION.—Continuous injection into crankcase through fixed jets. Fuel supplied and metered by McCulloch two-stage rotary-pump with altitude compensator.
FUEL SPECIFICATION.—MIL-F-5572 Grade 115/145 aviation fuel mixed in ratio of 10 to 1 with oil to Mil-O-6082 Grade 1065.
IGNITION, LUBRICATION, AIRSCREW DRIVE, STARTING AND MOUNTING.—Same as for Model 4318B.
ACCESSORIES.—Alternator pad and auxiliary drive pad on rear cover casting. Both gear-driven.
DIMENSIONS.—
Overall length 34.5 in. (87.6 cm.).
Overall width 22.0 in. (55.8 cm.).
Overall height 12.3 in. (31.2 cm.).
WEIGHT (complete, less airscrew hub).—114 lb. (51.7 kg.).
POWER RATING.—
Rated output 110 h.p. at 4,100 r.p.m.
CONSUMPTION.—
Fuel/oil mixture 0.85 lb./h.p./hr. (0.38 kg./b.h.p./hr.).

THE McCULLOCH MODEL TC6150.
Military designation: O-150-4.

The Model TC6150 is a turbo supercharged version of the 6318, to which it is otherwise similar.

TYPE.—Six-cylinder horizontally-opposed air-cooled supercharged two-stroke.
CYLINDERS, PISTONS, CONNECTING RODS, IGNITION, LUBRICATION, AIRSCREW DRIVE, STARTING AND MOUNTING.—Same as Model 4318B.
CRANKSHAFT, CRANKCASE, VALVE GEAR, INDUCTION, FUEL SPECIFICATION AND ACCESSORIES.—Same as for Model 6318.
SUPERCHARGER.—Exhaust-driven open-end design with radial inflow single-stage turbine and single-stage centrifugal compressor.
DIMENSIONS.—
Overall length 44.5 in. (113 cm.).
Overall width 22.0 in. (55.8 cm.).
Overall height 17.0 in. (43.2 cm.).
WEIGHT (Dry).—
142 lb. (64.4 kg.).
POWER RATINGS.—
Rated output at sea level 120 h.p.
Rated output at 30,000 ft. (9,150 m.) 86 h.p.
CONSUMPTION.—
Fuel/oil mixture 0.80 lb./b.h.p./hr. (0.36 kg./b.h.p./hr.).

NELSON
BARMOTIVE PRODUCTS, INC.

HEAD OFFICE AND WORKS : 440, PERALTA AVENUE, SAN LEANDRO, CALIFORNIA.

President : W. W. Barton.
Vice-President and General Manager : C. H. Whitner.
Secretary and Treasurer : J. M. Hardin.
Chief Engineer : J. F. Ryan.
Special Consultant : Ted Nelson.
Sales Representatives : W. F. and John Barnes Company, 301, South Water Street, Rockford, Ill.

Barmotive Products, Inc., among their many industrial activities, produce the Nelson H-63 four-cylinder two-cycle air-cooled engine. Intended as a power unit for single-seat experimental helicopters and aircraft employing the "ducted fan" principle, it is a development of the earlier Nelson H-59, which was tested and approved by the Civil Aeronautics Authority as a power source for auxiliary-powered sailplanes and has been described fully in previous editions of "All the World's Aircraft.

THE NELSON H-63.

The H-63 engine was designed to provide a small power-unit having a high ratio of horse-power to basic weight (42 h.p./48 lb.). Liberal use of magnesium and aluminium-alloys is made to keep the weight down to the minimum.

The thrust bearing is suitable for a pusher or tractor type airscrew. Installation can be made with the crankshaft in either the horizontal or vertical position, each position requiring its own specially modified carburettor.

TYPE.—Four-cylinder horizontally-opposed air-cooled, two-stroke.
CYLINDERS.—Bore 2 1/16 in. (68.3 mm.). Stroke 2 3/4 in. (70 mm.). Displacement 63 cub. in. (1.03 litres). Compression ratio 8 : 1. Each cylinder complete is machined from an aluminium-alloy casting, the bore being porous-chrome plated for wear resistance. Cylinders bolted to and detachable from crankcase.
PISTONS.—Aluminium-alloy casting. Two piston rings. Standard automotive type gudgeon pins.
CONNECTING RODS.—Nitralloy with needle bearing in big end and caged roller bearing in little end.
CRANKSHAFT.—Four-throw Nitralloy shaft on four ball bearings.
CRANKCASE.—Two-piece case divided on horizontal centre-line. Each half is a magnesium casting.
INDUCTION.—Standard Rochester Type 7004600 automobile carburettor specially modified for this engine. Fuel/oil mixture valved from crankcase through specially-designed rotary valve driven by crankshaft. Intake to and exhaust from cylinders through ports. Exhaust stacks are of aluminium-alloy.
FUEL.—80 octane gasoline and SAE 30 paraffin-base oil in 8 : 1 mixture for fuel and lubrication.

IGNITION.—Electrical source is 6- or 12-volt battery. Two ignition coils with standard wiring. One Champion No. 5 commercial plug per cylinder.

LUBRICATION.—See under "Fuel."

AIRSCREW DRIVE.—Direct, counter-clockwise. Type of airscrew varies with application. Recommended diameter for use with ultra-light aircraft or power-assisted sailplanes is 42 inches (1.06 m.).

STARTING.—Steel cable from cockpit to starter mechanism. Electric starter optional.

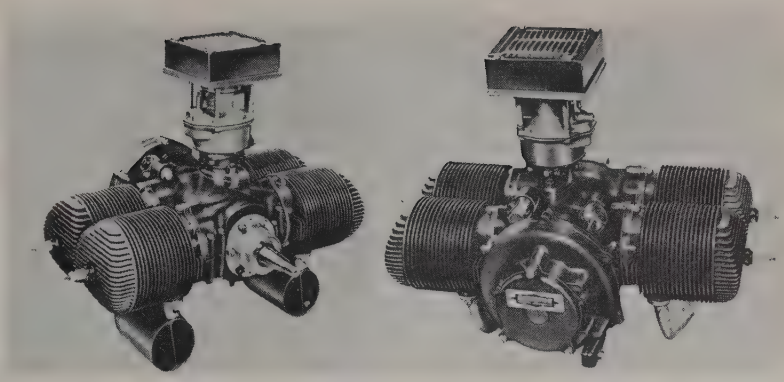
MOUNTING.—Four Lord-type mounts, two on each half of crankcase.

DIMENSIONS.—
Overall length 18 in. (45.7 cm.).
Overall height 17.5 in. (44.4 cm.).
Overall width 25 in. (63.5 cm.).

WEIGHTS.—
Dry, less carburettor and exhaust stacks 48 lb. (21.8 kg.).
Carburettor (with filter) 4 lb. (1.8 kg.).
Exhaust stacks (2) 2.5 lb. (1.1 kg.).
Coils (2) 2.5 lb. (1.1 kg.).

POWER RATING.—
Rated output 42 h.p. (min.) at 4,000 r.p.m.

CONSUMPTION.—
Fuel/oil 5.5 U.S. gallons (20.8 litres) per hour at full throttle.



Two views of the 42 h.p. Nelson H-63 four-cylinder two-stroke engine.

PRATT & WHITNEY

THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST HARTFORD 8, CONNECTICUT.

Established: 1925.

Vice-President: Wright A. Parkins.

General Manager (Connecticut): L. C. Mallet.

Engineering Manager: A. E. Smith.

Assistant Engineering Manager: Perry W. Pratt.

Sales Manager: E. Tillinghast.

Factory Manager: John L. Bunce.

Pratt & Whitney concentrates on the manufacture of high-powered gas-turbines and radial air-cooled engines. It was founded in 1925 by a small group of aeronautical engine experts as the Pratt & Whitney Aircraft Company and is now a division of the United Aircraft Corporation.

Production space in the main East Hartford, Connecticut, plant and in the branch plants at North Haven, Southington and Meriden, Connecticut, totals more than 7,000,000 square feet. Employment in all Pratt & Whitney plants was over 40,000 on January 1, 1957.

In 1957 over 80% of Pratt & Whitney production capacity was devoted to gas-turbine engines. Details of these engines will be found in Part I of this Section.

THE PRATT & WHITNEY R-2000 TWIN-WASP D SERIES.

TYPE.—Fourteen-cylinder two-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 5½ in. (139.50 mm.). Displacement 2,004 cub. in. (32.8 litres). Built up of cast aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel. Forged aluminium sleeve in which deep-cut cooling fins have been machined (muffs) are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, seating on inserts which are shrunk into head. Pressure baffles are provided.

PISTONS.—Of forged aluminium, ribbed on underside of head for additional cooling. Each piston has three compression-rings, one oil scraper-ring and one pair of dual oil control rings.

CONNECTING RODS.—The master rod cluster consists of the master rod, with detachable cap and two piece lead-silver bearing, and six I-section articulated rods for each row. Each articulated rod has bronze bushings at both piston and knuckle pin ends.

CRANKSHAFT.—Forged steel, two-throw counter-weighted, one-piece type, supported by three plain lead-silver bearings in the crankcase section.

CRANKCASE.—Made up of seven sections. The three parts for the power section, or crankcase proper, are machined together from aluminium forgings. The magnesium nose section houses the reduction gears and has provision for the Hamilton Standard Hydromatic or other full-feathering airscrews. The power sections are joined by through bolts. The magnesium blower section, bolted to the power section, contains the supercharger and carries bronze-bushed forged-steel engine mounting lugs. The blower intermediate section, bolted to the blower section, supports the downdraft carburettor and houses the impeller gear train. The accessory section, also of magnesium, is fastened to the lower intermediate section by means of stud bolts.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Exhaust valves are sodium-cooled and faced with stellite. Valves are actuated by plain bearing rocker arms and push-rods. Two shelf-mounted cams, one in front power section and one in rear, driven by spur reduction gears directly off the crankshaft at one-eighth crankshaft speed.

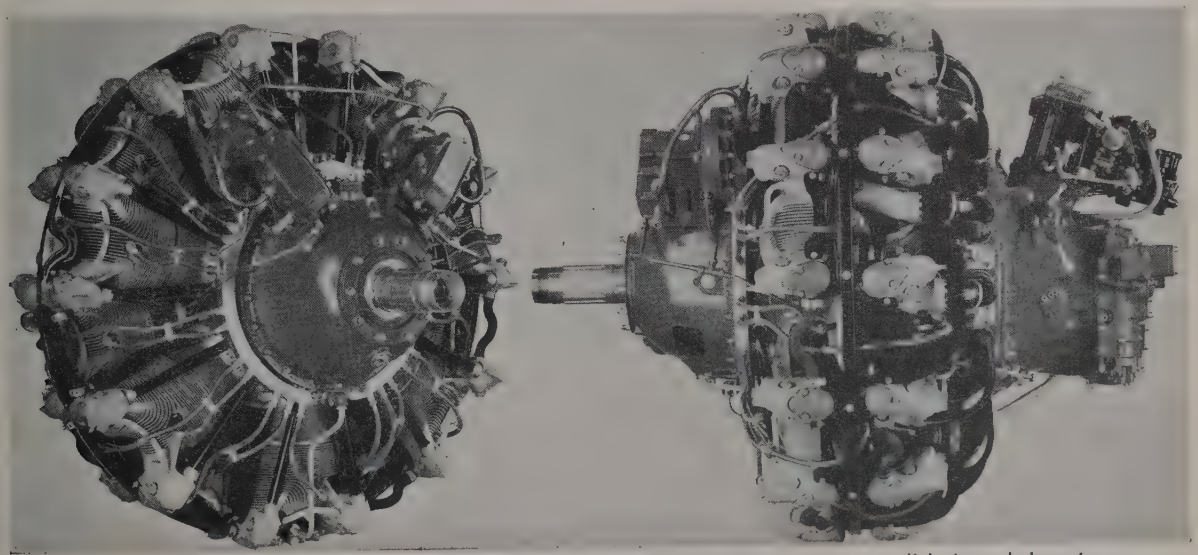
INDUCTION SYSTEM.—Stromberg PD-12F13 pressure-injection carburettor with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passage and is thrown centrifugally through small holes in a slinger ring mounted on the impeller drive shaft. Combustion air enters the supercharger at right angles to the screen of vaporized fuel thrown from the slinger ring. Fuel air mixture after being compressed collects in the blower rim from where it is carried through intake pipes to the individual cylinders. The "washboard" impeller case provides better fuel vaporization, preventing the accumulation and flow of liquid fuel along the wall by returning it to the air stream.

SUPERCHARGER.—Either single-speed or two-speed, and is single-stage. Impeller is driven by spring-loaded flexible drive gears to absorb shocks and to equalize driving loads, plus cone clutches with creeper desludgers in the case of two-speed drive engines.

IGNITION SYSTEM.—Two nose-mounted Scintilla SF-14LN-8 magnetos each operate an individual set of spark-plugs through a single ignition manifold attached to the front of the power section. Magnetos, manifold and spark-plug leads are radio-shielded.

LUBRICATION.—Forced feed lubrication by a gear-type oil pump to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears of Pratt & Whitney design. Ratio .500 : 1. Airscrew shaft supported at the



The 1,450 h.p. Pratt & Whitney R-2000 Twin-Wasp fourteen-cylinder two-row radial air-cooled engine.

THE PRATT & WHITNEY TWIN WASP R-2000 D SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Max. Continuous Power	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
D5	1,450 h.p. at 2,700 r.p.m. at 2,800 ft. (855 m.)	1,200 h.p. at 2,550 r.p.m. at 6,400 ft. (1,952 m.)	—	—	6.5 : 1	7.15 : 1	.500 : 1	1,585 lb. (719 kg.)	49.10 in. (1.247 m.)	100/130
2SD13-G	1,450 h.p. at 2,700 r.p.m. at 1,000 ft. (305 m.)	1,200 h.p. at 2,550 r.p.m. at 5,000 ft. (1,525 m.)	1,100 h.p. at 2,550 r.p.m. at 14,000 ft. (4,265 m.)	—	6.5 : 1	7.15 : 1 (L) and 9.52 : 1 (H)	.500 : 1	1,605 lb. (728 kg.)	49.10 in. (1.247 m.)	100/130

crankshaft end in two concentric bearings mounted in a support plate at the rear of the nose housing and at the front of the nose section by a deep-groove ball-bearing. The airscrew shaft is completely decoupled from the crankshaft.

ACCESSORY DRIVES.—All accessories are grouped in the rear and are driven through intermediate gear train by a single drive-shaft spline fitted to the rear of the crank-shaft.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY R-2800 DOUBLE WASP CB SERIES.

TYPE.—Eighteen-cylinder two-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 6 in. (152.4 mm.). Capacity 2,804 cub. in. (45.9 litres). Built up of forged aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel. Forged aluminium sleeves in which deep-cut cooling fins have been machined, are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, the inlet seating on a bronze insert and the exhaust on a steel insert, both of which are shrunk into the head. Pressure baffles are provided.

PISTONS.—Forged aluminium pistons of full skirt type. Three compression rings, one pair of dual oil control rings and one oil scraper ring. Top compression ring chromium plated on the face which bears against the cylinder wall.

CONNECTING RODS.—The rod assembly consists of a one-piece master rod and eight I-section articulated rods attached to each master rod by knuckle pins. The master rod bearings are one-piece steel shells covered on the inside and outside with leaded silver. The articulated rods have bronze bushings at the piston pin end and ride on silvered knuckle pins at the knuckle pin end.

CRANKSHAFT.—Two-throw crankshaft machined from three steel forgings which divide at the crankpins and are joined together by a face spline and bolt. Crankshaft assembly supported by steel-backed lead-silver bearings mounted in the front, centre and rear main crankcase sections. Weights of reciprocating and rotating parts connected to the crankpin are counterbalanced by weights, the front counter balance and a portion of the improved rear one being mounted as bifilar dampers. Mounted at each end of the crankshafts are two counter-weights revolving at twice-crankshaft speed to eliminate second-order "whirl."

CRANKCASE.—Main crankcase composed of three forged aluminium-alloy sections held together by through bolts. Nose-section houses the reduction gears and torquemeter and has provisions for full-feathering, reversible governor. Supercharger case attached to the rear of the main crankcase section and also houses an impeller. Intermediate rear case is attached to supercharger case and supports at its forward face a vaned diffuser plate and provides mounting surface for a pressure type carburettor. Rear section provides accessory mounting pads.

REMARKS.—The valve gear, induction-system, supercharger, ignition system, lubrication system and accessory-drives are substantially the same as in the Twin-Wasp, but with Stromberg PR-58E5 carburettor and Scintilla DLN-10 magnetos. The ignition system is optionally high or low voltage. Water-injection equipment may be used with the "CA" Double-Wasp to give added power for take-off and emergencies.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY R-4360 WASP MAJOR CB SERIES.

TYPE.—Twenty-eight-cylinder four-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 6 in. (152.4 mm.). Capacity 4,363 cub. in. (71.5 litres). Cylinders, which are similar to those of R-2800 Series, are arranged helically around the crankcase and pressure baffles are provided for individual cylinders and for each bank of four. All cylinders are completely interchangeable.

PISTONS.—Generally the same as for the Double Wasp, with reinforced internal bosses.

CONNECTING RODS.—Rod assembly for each row of seven cylinders consists of master rod with detachable cap, two-piece lead-silver bearing, and six I-section articulated or link rods. Each link rod has a bronze bushing at the piston end and rides on a silvered knuckle pin.

CRANKSHAFT.—One-piece crankshaft of forged steel has four throws and is supported in the crankcase by five steel-backed lead-silver main bearings. Weights of the reciprocating parts connected to the crankpin are counterbalanced by two fixed and two bifilar counterweights.

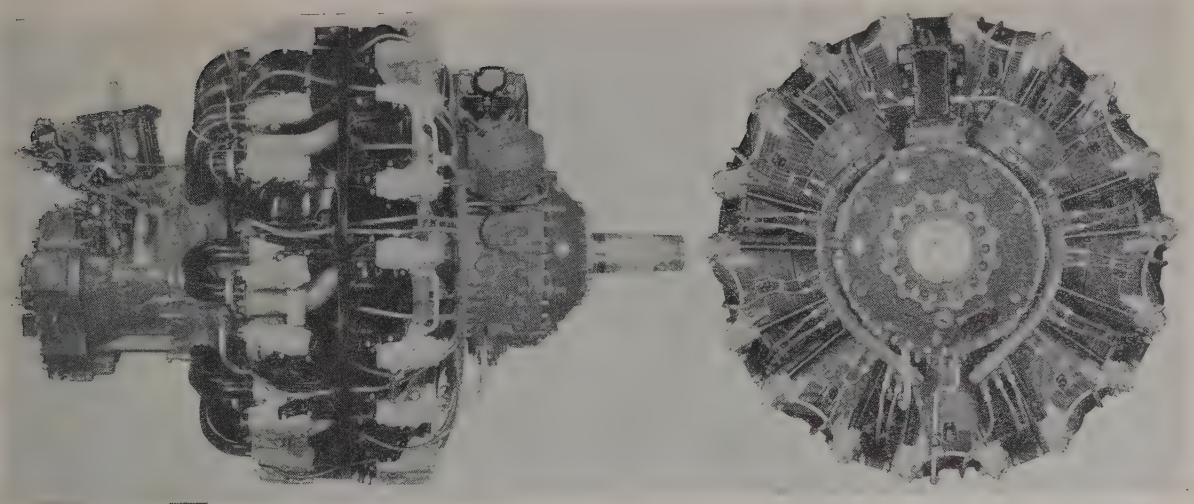
AIRSCREW SHAFT.—Supported at the crank-shaft end by a plain lead-bronze bearing and at the airscrew end by a roller-bearing to carry radial loads and a deep-groove ball-bearing which absorbs engine thrust.

CRANKCASE.—The power section case made up of five sections, all except the front and rear sections being substantially alike. The parts for the power section are machined from aluminium forgings and are held together with through bolts. All other crankcase sections are magnesium castings. Attached to front of power section by studs is the magneto section, which mounts four interchangeable magnetos and contains the torquemeter. The nose section

THE PRATT & WHITNEY R-2800 DOUBLE WASP CB SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Max. Continuous Power (low blower)	Max. Continuous Power (high blower)	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
*CB3	‡2,400 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) 2,050 h.p. at 2,700 r.p.m. at 6,000 ft. (1,830 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	7.29 : 1	.45 : 1	2,357 lb. (1,070 kg.)	52.8 in. (1,342 mm.)	100/130
*CB4	‡2,500 h.p. at 2,800 r.p.m. at 2,500 ft. (760 m.) 2,200 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	1,900 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	—	7.29 : 1	.45 : 1	2,357 lb. (1,070 kg.)	52.8 in. (1.342 mm.)	108/135
†CB16	‡2.400 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) 2,050 h.p. at 2,700 r.p.m. at 6,000 ft. (1.830 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,700 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	7.29 : 1 (L) 8.58 : 1 (H)	.45 : 1	2,390 lb. (1,084 kg.)	52.8 in. (1,342 mm.)	100/130
†CB17	‡2,500 h.p. at 2,800 r.p.m. at 2,500 ft. (760 m.) 2,200 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,700 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	1,900 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	1,750 h.p. at 2,600 r.p.m. at 13,500 ft. (4,115 m.)	7.29 : 1 (L) 8.58 : 1 (H)	.45 : 1	2,390 lb. (1,084 kg.)	52.8 in. (1,342 mm.)	108/135

* Single-speed single-stage supercharger. † Two-speed single-stage supercharger. ‡ With water injection.



The 2,400 h.p. Pratt & Whitney R-2800 Double-Wasp CA and CB Series eighteen-cylinder radial engine.

houses the planetary reduction gearing and has provision for full-feathering, reversible airscrew governor. Attached to rear of power section by studs is the supercharger housing, enclosing the supercharger drives and impeller. Behind the supercharger housing, also attached with studs, is the accessory section. On this is mounted a down-draft pressure-type carburettor. This section houses the accessory-drive mechanism and provides mounting pads for the radial mounting of all accessories and automatic power controls to permit greater accessibility for servicing. Normally nothing is mounted on the rear of the engine but a co-axial accessory drive may be provided as optional equipment.

Valve Gear.—Rocker boxes are part of the cylinder head, extending fore and aft. Rocker arms with plain bearings are actuated by enclosed push-rods. Double-track shelf-mounted cams inside the crankcase between the rows of cylinders operate the exhaust valves of the forward row of cylinders and the intake valves of the aft row. Cams are driven by spur reduction-gears from the crankshaft at one sixth crankshaft speed.

Induction System.—Stromberg four-barrelled pressure-type carburettor, with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passages and is thrown centrifugally through small holes between the impeller blades to mix with the combustion air. The fuel-air mixture, after passing through the diffuser to the blower rim, is carried to the cylinders through seven intake pipes, one for each bank of four cylinders.

Supercharger.—There are two basic types in unrestricted engines: a single-stage single-speed supercharger suitable for use with an exhaust driven turbo-supercharger, and a single-stage hydraulically driven variable-speed supercharger. The two-piece impeller assembly consists of a machined impeller, the straight blades of which are blended with the curved entrance blades of an inducer.

Ignition System.—Four Scintilla magnetos, each with an integral distributor, operate at one-half crankshaft speed. Dual ignition.

Lubrication.—Forced-feed lubrication provided by a gear-type oil pump to all parts of the engine.

Reduction Gear.—The planetary reduction gears are of Pratt & Whitney design and are spur gears with ratio of .375 : 1.

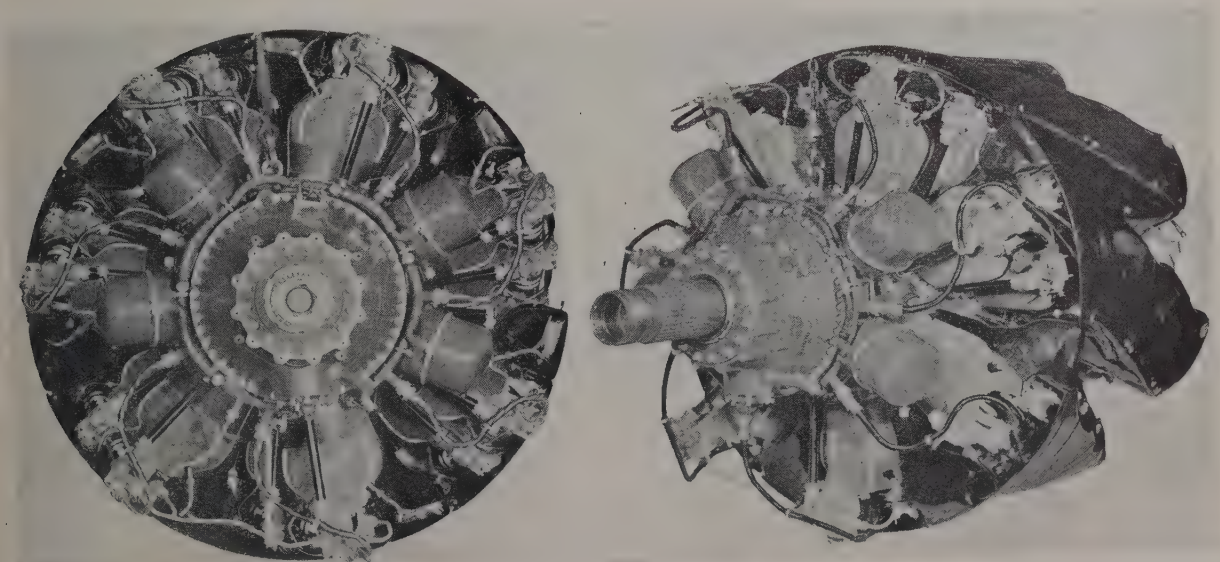
Accessory Drives.—All accessories mounted radially on the periphery of the rear section. All accessory-drive gears driven by a bevel-gear revolving at crankshaft speed.

Dimensions, Weights and Performance.—See Table.

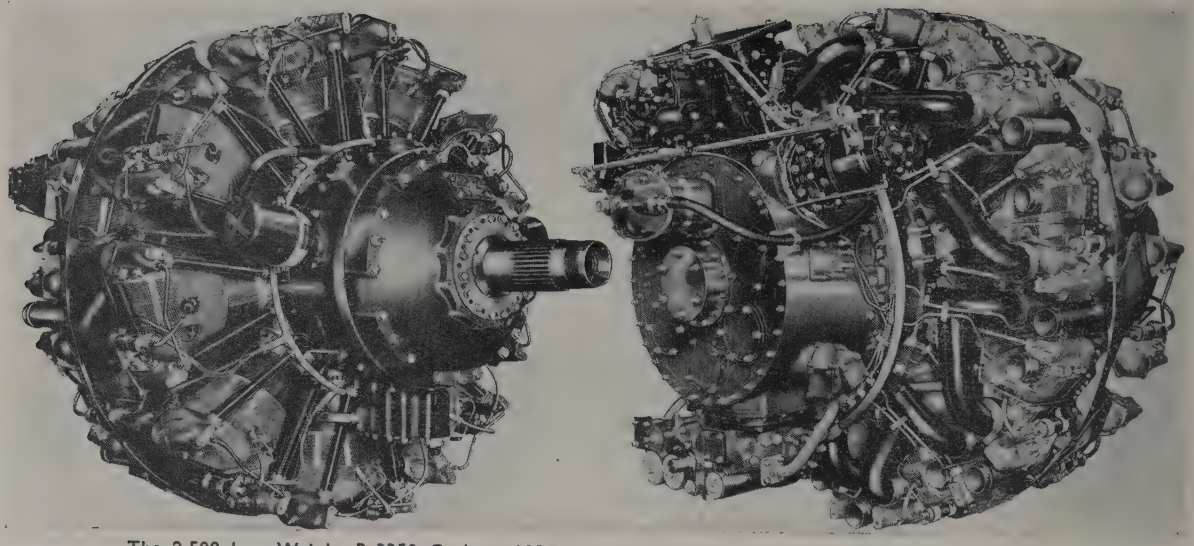
THE PRATT & WHITNEY R-4360 WASP MAJOR CB SERIES.

Engine Model	Take-off Power	Normal Rating	Max. Continuous Power	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
CB2	‡3,500 h.p. at 2,700 r.p.m. at 500 ft. (150 m.) 3,250 h.p. at 2,700 r.p.m. at 700 ft. (215 m.)	2,650 h.p. at 2,550 r.p.m. at 5,500 ft. (1,675 m.)	2,800 h.p. at 2,550 r.p.m. at 3,500 ft. (1,070 m.)	6.7 : 1	6.375 : 1	.375 : 1	3,682 lb. (1,670 kg.)	55 in. (1,397 mm.)	108/135

‡ With water injection. Note: The CB2 Model is suitable for use with exhaust-driven supercharger.



The 3,500 h.p. Pratt & Whitney R-4360 CB Series four-row radial air-cooled engine.



The 2,500 h.p. Wright R-3350 Cyclone 18BD eighteen-cylinder two-row radial air-cooled engine.

WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION.

HEAD OFFICE AND WORKS: WOOD-RIDGE, N.J.

Chairman of the Board and President: Roy T. Hurley.

Vice-President and General Manager: J. V. Miccio.

Vice-President and Director of Engineering: Jack O. Charshafian.

The Wright Aeronautical Corporation merged with the Curtiss Aeroplane and Motor Company in 1929 to form the Curtiss-Wright Corporation, of which Wright Aeronautical is now the largest division.

Wright piston engines range in power from 800 to 2,800 horsepower, while the Wright Turbo Compound, a combination piston and turbine engine which develops up to 3,700 h.p. is also in quantity production and is the only compound engine powering production aircraft.

All Lockheed Constellation airliners are powered by four Wright R-3350 eighteen-cylinder engines. The Wright Turbo Compound engine powers the Lockheed P2V and WV and Martin P5M patrol aircraft and the Lockheed R7V-1 transport in service in the U.S. Navy, as well as the Fairchild C-119 and Lockheed C-121 transports of the U.S.A.F. and the Canadair CL-28 maritime reconnaissance aircraft of the R.C.A.F. The Turbo Compound also powers the later versions of the Super Constellation, the Lockheed Starliner and the Douglas DC-7 airliner.

Military production of the R-1300 Cyclone 7 Series and R-1820 Cyclone 9 Series engines is handled exclusively by the Lycoming Division of the AVCO Manufacturing Corporation; commercial versions are still handled by Wright. Details of these engines have appeared in earlier editions of "All the World's Aircraft."

In 1956, Wright took long-term leases on factories belonging to the Studebaker-Packard Corporation, at Utica, Mich., and Chippewa, Ind., and purchased the Aerophysics Development Corporation of Santa Barbara, Cal. All three plants are operating as wholly-owned subsidiaries of Curtiss-Wright. Present production in them is concentrated on production of engine components and diesel engines for aviation, automotive, marine and industrial applications. Later, they will be used for the manufacture of gas-turbine engines and missiles.

Wright is also in production with the J65 turbojet engine, details of which will be found in Part I of this Section, and is actively engaged in development of high-powered rocket engines and of ramjets for guided missile application.

THE WRIGHT R-3350 CYCLONE 18 SERIES.

TYPE.—Eighteen-cylinder double-row geared and supercharged radial air-cooled.

CYLINDERS.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Capacity 3,347 cub. in. (54.56 litres). Universal-type forged head with "coarse/fine" finning and increased finning in area of exhaust-valve for improved cooling. Forged head has greater total cooling area than cast type used on earlier C18's. Rocker boxes are slightly smaller than type previously used and are held in place by five studs.

PISTONS.—Tapered interior to accommodate tapered articulated and master-rod ends. Five piston rings, three oil and two compression.

CONNECTING RODS.—Gudgeon-pin end of articulated rods tapered to accommodate maximum thrust on down stroke and lesser thrust on return stroke. Gudgeon-pin and knuckle pin bearings of bronze. Silver master-rod bearing is steel-backed and end-sealed. All rods shot-peened during manufacture.

CRANKSHAFT.—Two-throw forged steel crankshaft dynamically-balanced with single-weight second-order balancers concentric with crankshaft.

CRANKCASE.—Eight-piece crankcase. Power section of forged steel front and rear sections of magnesium-alloy. Front or nose section in two pieces to facilitate maintenance. Reduction gears are "high overlap" type for increased tooth contact. Ball thrust-bearing mounted in front section and roller-main bearings mounted in webs of crankcase power section. Electric torque pressure indicator and provision for double-acting hydraulic airscrew provided in front section.

VALVE GEAR.—Valve seats Stellite-faced and shrunk into aluminium-alloy head. Rocker-arm ratio 1 : 1. Rocker-arms pivot on plain bearings. Push-rods enclosed in tubular housings with gland-type seals.

FUEL METERING.—BA, BD and CA models manufactured with direct fuel-injection. Fuel-injection equipment includes two nine-cylinder pumps, master control, equalizer, bar fuel lines and cylinder injection nozzles. Supercharger impeller is new "inducer" type which improves both efficiency and capacity of impeller. "Siamese" Y-type intake pipes serve two cylinders each. Some CA models inject fuel at supercharger impeller.

LUBRICATION.—Dry sump. Front sump pump scavenges to rear pump which

THE WRIGHT R-3350 CYCLONE 18 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
745C18BA1 (Fuel Injection)	2,200 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,400 r.p.m. at 4,800 ft. (1,465 m.)	1,800 h.p. at 2,400 r.p.m. at 18,000 ft. (5,490 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,780 lb. (1,261 kg.)	100/130
749C18BD1 (Fuel Injection)	2,500 h.p. at 2,800 r.p.m.	2,100 h.p. at 2,400 r.p.m. at 4,400 ft. (1,340 m.).	1,470 h.p. at 2,400 r.p.m. at 11,000 ft. (3,350 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,944 lb. (1,335 kg.)	100/130
956C18CA1 (Fuel Injection)	2,700 h.p. at 2,900 r.p.m.	2,300 h.p. at 2,600 r.p.m. at 6,300 ft. (1,920 m.)	2,000 h.p. at 2,600 r.p.m. at 15,800 ft. (4,820 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,957 lb. (1,342 kg.)	115/145
975C18CB1 (Fuel Injection)	2,800 h.p. at 2,900 r.p.m.	2,400 h.p. at 2,600 r.p.m. at 5,300 ft. (1,615 m.)	1,600 h.p. at 2,400 r.p.m. at 12,500 ft. (3,800 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	3,029 lb. (1,374 kg.)	115/145

THE WRIGHT TC18 TURBO COMPOUND SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
972TC18DA1 (Fuel Injection)	3,250 h.p. at 2,900 r.p.m.	2,650 h.p. at 2,600 r.p.m. at 6,500 ft. (1,980 m.)	2,450 h.p. at 2,600 r.p.m. at 17,900 ft. (5,455 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	3,551 lb. (1,611 kg.)	115/145
988TC18EA1 (Fuel Injection)	3,400 h.p. at 2,900 r.p.m.	2,800 h.p. at 2,600 r.p.m. at 4,700 ft. (1,435 m.)	1,910 h.p. at 2,400 r.p.m. at 13,500 ft. (4,100 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	3,645 lb. (1,653 kg.)	115/145
988TC18EA4 (Fuel Injection)	3,400 h.p. at 2,900 r.p.m.	2,920 h.p. at 2,600 r.p.m.	1,950 h.p. at 2,400 r.p.m.	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	—	115/145

supplies oil at pressure for lubrication. Front sump also has regulator for reduction-gear pressure. Crankcase has stationary oil jets built in.

IGNITION.—Either high or low-tension. Low-tension type includes one generator mounted on rear cover, two 18-point distributors mounted on front section and distributing low-tension current to high-tension coil on each cylinder. This system cuts leakage and arcing and eliminates long travel of high-tension current. No supercharging of ignition system necessary for high-altitude flights.

ACCESSORIES.—Rear cover strengthened for mounting of power take-off for cabin supercharging, etc. Double acting airscrew pitch control torquemeter, priming system, fire-seal adapter flange, cooling-air deflectors, accessory drives and covers, Scintilla magnetos.

OPTIONAL EQUIPMENT.—Manifold pressure regulator, .35, .4375 or .5625 reduction gears, anti-detonant (water injection) equipment.

DIMENSIONS.—
Diameter 55.62 in. (1,413 mm.).
Length (Models 956 and 975) 78.54 in. (1,995 mm.), (Model 749) 78.52 in. (1,994 mm.).

WEIGHTS AND PERFORMANCE.—
See Table.

THE WRIGHT TC18 TURBO COMPOUND.

The Turbo Compound combines an improved design R-3350 engine and three exhaust-driven "blow-down" turbines equally disposed around the engine. Power recovered from the engine exhaust gases by the turbines is fed back into the rear of the engine crankshaft by means of a gear train operating in conjunction with three fluid couplings. This compounding arrangement is claimed to convert into useful power approximately 20 per cent. of the available heat energy normally lost through the engine exhaust. The turbines are called "blow-down" turbines because the high velocity of the gases they use comes from the gas blowing down across the exhaust valve.

The Turbo Compound engine completed its first 50-hour Official Flight Approval Test in October, 1949, and in January, 1950, the 150-hour Official Navy Qualification Test was completed. Delivery of the first production engines began in March, 1950 and more than 9,000 had been delivered by mid-1956. Between them they had accumulated seven million flying hours.

The Turbo Compound may be installed in existing types of aircraft fitted with the standard Cyclone 18 engine. The diameter of the Turbo Compound is similar to that of the Cyclone 18 and the overall length is increased by only a few inches, so that the new engine fits within the cowling lines of existing installations with a minimum of modification.

Tests conducted by the Wright Aeronautical Division indicate that a given aircraft powered with the Turbo Compound engine can (*a*) fly 20 per cent. further for the same fuel consumption than it can if equipped with the conventional type; or (*b*) operate the same range with 20 per cent. less fuel.

The following are some of the pertinent characteristics of the Turbo Compound engine :—

COMMERCIAL DESIGNATIONS.—972TC18DA1, 2, 3, 4 and 988TC18EA1, 2, 3, 4, 5, 6.

CYLINDERS.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Swept volume 3,347 cub. in. (54.56 litres). Compression ratio 6.7 : 1. Developed from C18BD1 forged cylinder with 40 per cent. more cooling fin area, additional attaching threads and increased radii at stress concentration points.

CRANKSHAFT.—Two-throw 180° shaft in three sections as in C18 Series, but material added to centre and rear crank checks to increase strength of crankshaft assembly.

VALVE GEAR.—As in C18 Series except that both inlet and exhaust valves are sodium-cooled. Valve stem diameter also increased from $\frac{7}{16}$ in. to $\frac{1}{2}$ in. to provide extra margin of strength. Valve guides of HC-250, a high-carbon ($2\frac{3}{4}$ per cent.) high chromium (25 per cent.) cast structure bordering on tool steel analysis. Stellite split-ring floating type valve seats shrunk into head.

SUPERCHARGER.—Two-speed, gear-driven off extension shaft coupled to rear of engine crankshaft. Blower ratios 6.46 and 8.67 : 1.

POWER RECOVERY TURBINE SYSTEM.—Consists of three "blow-down" exhaust-driven turbine units clamped and indexed to adapters bolted to engine front supercharger casing. Each turbine fed by exhaust from six cylinders through three paired pipes, two pairing adjacent cylinders in front and rear rows respectively, and one pairing adjacent front and rear cylinders. Turbine wheel has Haynes Stellite No. 31 buckets welded to Inconel X disc and is splined to stainless steel shaft aligned by two steel-backed silver bearings mounted at either end of shaft support pedestal. Turbine shafts are geared to extension shaft coupled to rear of engine crankshaft through three vortex-flushed fluid couplings using engine oil. Turbine cooled by ram air ducted from front of engine into enclosing muff and forced by 7-in. impeller on shaft through holes at base of each wheel bucket into upper turbine shroud with tangential outlet discharging into exhaust outlet. Turbine shaft support pedestal on spring diaphragm to permit wheel to move slightly in all radial directions. Upper end of pedestal equipped with plate-type friction damper in which half the plates are fixed to turbine nozzle support and half to pedestal. Loading between plates provided by eight springs compressed to pre-determined load. Lubricating oil supplied to turbine unit from drilled passage in front supercharger housing and is scavenged by gravity drain.

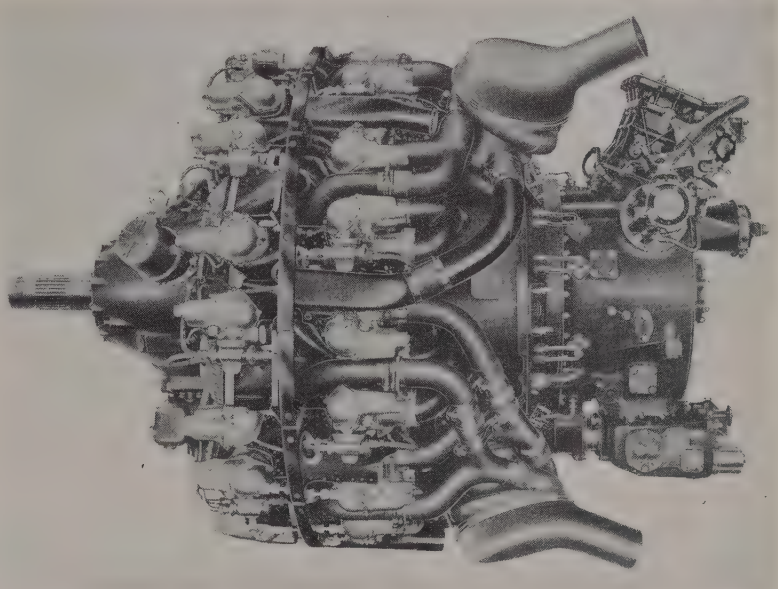
AIRSCREW REDUCTION GEAR RATIO (DA1, 2, 3, 4 and EA1, 3, 4, 6).—
0.4375 : 1.

AIRSCREW REDUCTION GEAR RATIO (EA2 and 5).—
0.35 : 1.

FUEL GRADE.—115/145.

DIAMETER (without cowling).—
56.6 in. (1,438 mm.).

WEIGHTS AND PERFORMANCE.—
See table.



The 3,400 h.p. Wright TC18 EA Series Turbo Compound engine.

THE WORLD'S AIRSHIPS

(CORRECTED TO SEPTEMBER 30th, 1957)

UNITED STATES OF AMERICA

The United States Navy is the only service in the World which operates airships and the sole supplier of airships to the U.S. Navy is the Goodyear Aircraft Corporation. Details of the current productions of Goodyear appear below.

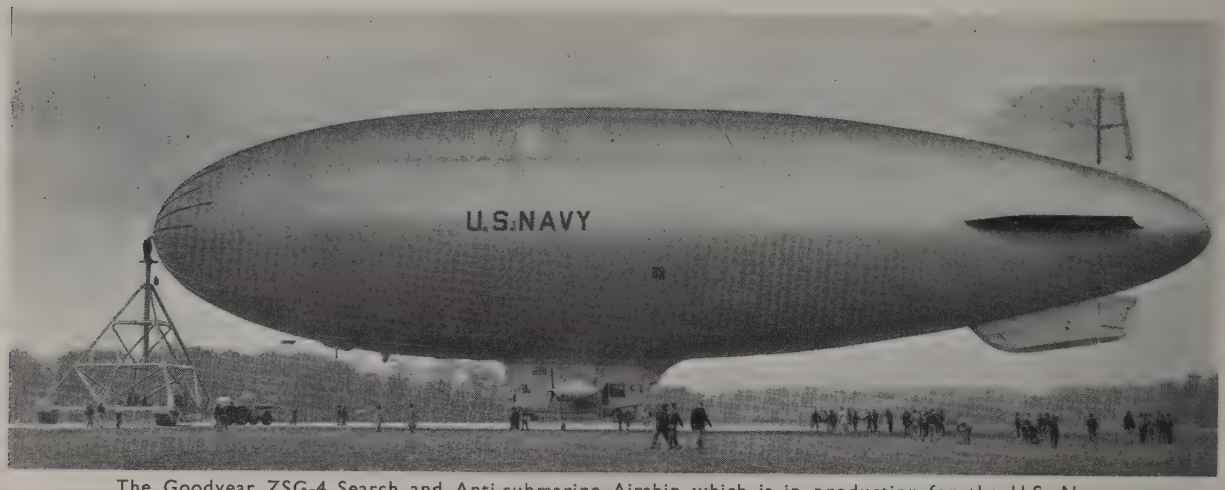
In 1954 the U.S. Navy abandoned the former classification of its airships and introduced a designation system similar to that used for naval aircraft, in which letters are used to define the function and identity of the craft and numbers to indicate the model and its modifications. The prefix Z signifies Lighter-than-Air, while the letter G identifies the Goodyear Aircraft Corporation. Other letters used i.e. P (patrol), S (search) and W (warning), are standard for all types of naval aircraft.

The previous designations and the new designations for all airships currently in service in, or in production for, the U.S. Navy are listed below :—

Old	*New*
ZP2K	ZSG-2
ZP3K	ZSG-3
XZP4K-1	XZSG-4
ZP4K-1	ZSG-4
XZP5K-1	XZS2G-1
ZP5K-1	ZS2G-1
ZPN-1	ZPG-1
ZP2N-1	ZPG-2
ZP2N-1W	ZPG-2W

The former L and G Class ships (old designations ZTL and ZTG) are no longer in service. They were formerly employed for pilot training but have now been replaced by the ZSG-2 and ZSG-3, which are modernised versions of the original K Class (or ZPK) airships.

GOODYEAR



The Goodyear ZSG-4 Search and Anti-submarine Airship which is in production for the U.S. Navy.

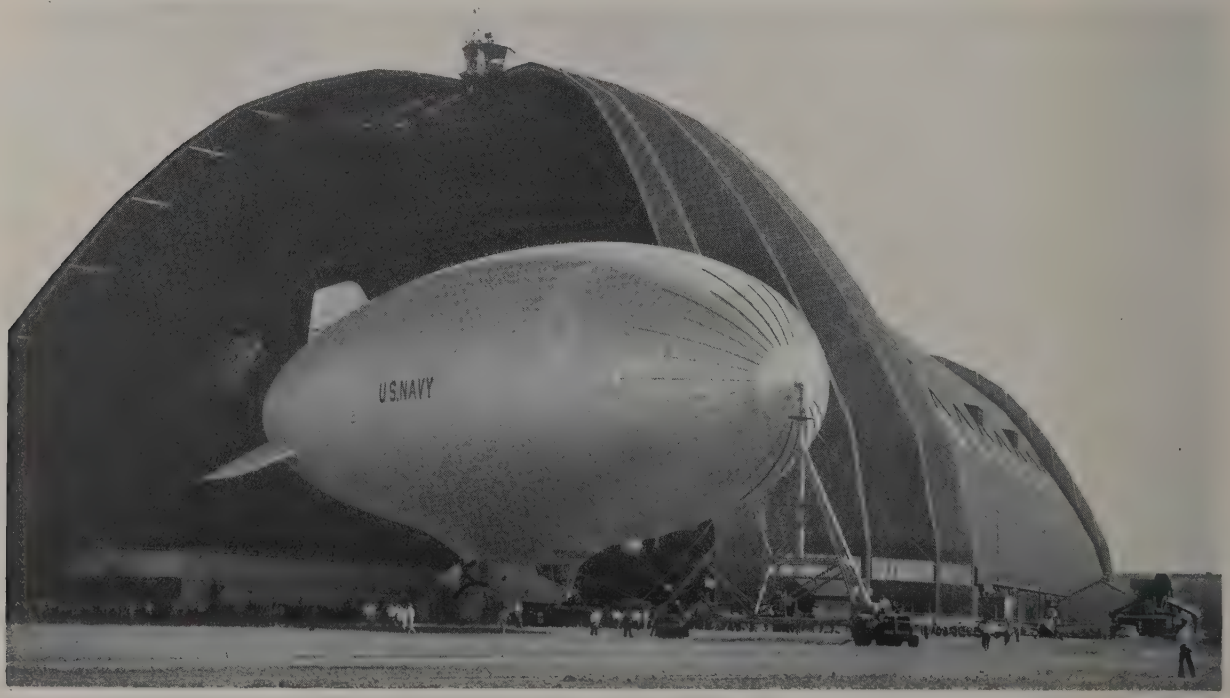
THE GOODYEAR AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS : AKRON 15, OHIO.

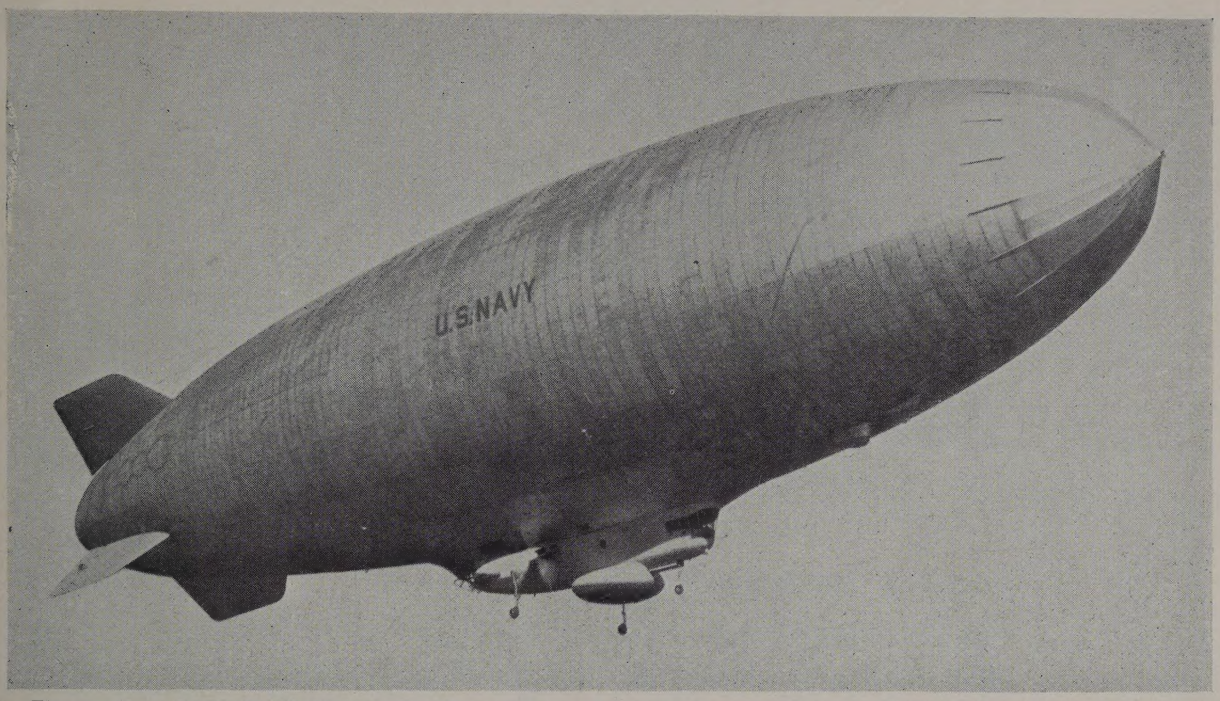
President : T. A. Knowles.
Vice President R. W. Richardson.
Chief Engineer : E. A. Brittenham.
Assistant Secretary : W. A. Runyan.

The Goodyear Aircraft Corpn. was formed on December 5, 1939, to take over from the parent Goodyear organization its principal manufacturing operations in the field of aeronautics, with the exception of tyres, inner tubes, bullet-proof fuel tanks and other rubber accessories. This also included the activities of the former Goodyear-Zeppelin Corpn., then mainly devoted to lighter-than-air craft.

During the war the Corporation was engaged in the manufacture of airships, aircraft, aircraft components and sub-assemblies. In the lighter-than-air field Goodyear fulfilled for the U.S. Navy a programme of upwards of 200 airships ranging from the L-type trainers of 123,000 cub. ft. (3,480 m.^{3}) capacity to the K and M patrol ships having a helium gas capacity of 456,000 cub. ft. (12,905 m.^{3}) and 725,000 cub. ft. (20,520 m.^{3}) respectively. After the completion of the airship programme in April, 1944, the activities of the Corporation were devoted solely to the production of aircraft, parts and sub-assemblies, as well as the manu-



The Goodyear XZS2G-1, prototype of a new class of Search Airship for the U.S. Navy.



The Goodyear ZPG-2 Patrol Airship (two 800 h.p. Wright R-1300 engines). A ZPG-2 established a new endurance record in March, 1957, by remaining in the air without refuelling for 264.2 hours.

facture of Goodyear wheels, brakes and other specialised components.

To-day, the Goodyear Aircraft Corpn. continues its rôle as the sole supplier of airships to the U.S. Navy's lighter-than-air section.

All Goodyear airships are of non-rigid construction. The cars are supported by a system of steel cables laced through the top and bottom of the rubberised-fabric envelope. The metal framework of the control cars is built in several assemblies and then joined together. Goodyear Bondolite sandwich material consisting of aluminium-alloy facings with a balsa wood core, is used exclusively in the construction of the control cars.

THE GOODYEAR ZSG-4.

The ZSG-4 (formerly designated ZP4K-1) non-rigid airship, an intermediate search craft, is a development of the well-known former K-type of ship. The maiden flight of the prototype was made in December, 1953, and Goodyear is now under contract to build an undisclosed number of this type of airship for the U.S. Navy.

The ZSG-4 incorporates the latest developments adaptable to such craft for the purpose of locating and attacking submarines. Operational versatility and endurance is augmented with special equipment providing for in-flight refuelling and for re-ballasting by a water pick-up system.

The ZSG-4 has a helium capacity of 527,000 cub. ft. (14,915 m.^{3}), has a maximum speed in the neighbourhood of 75 m.p.h. (120 km.h.) and is manned by a crew of eight officers and ratings.

No further details are available for publication.

THE GOODYEAR ZS2G-1.

The ZS2G-1 (formerly ZP5K-1) is the first of a new class of non-rigid airship which is intended to replace the earlier K ships which were used in anti-submarine warfare service in the last war.

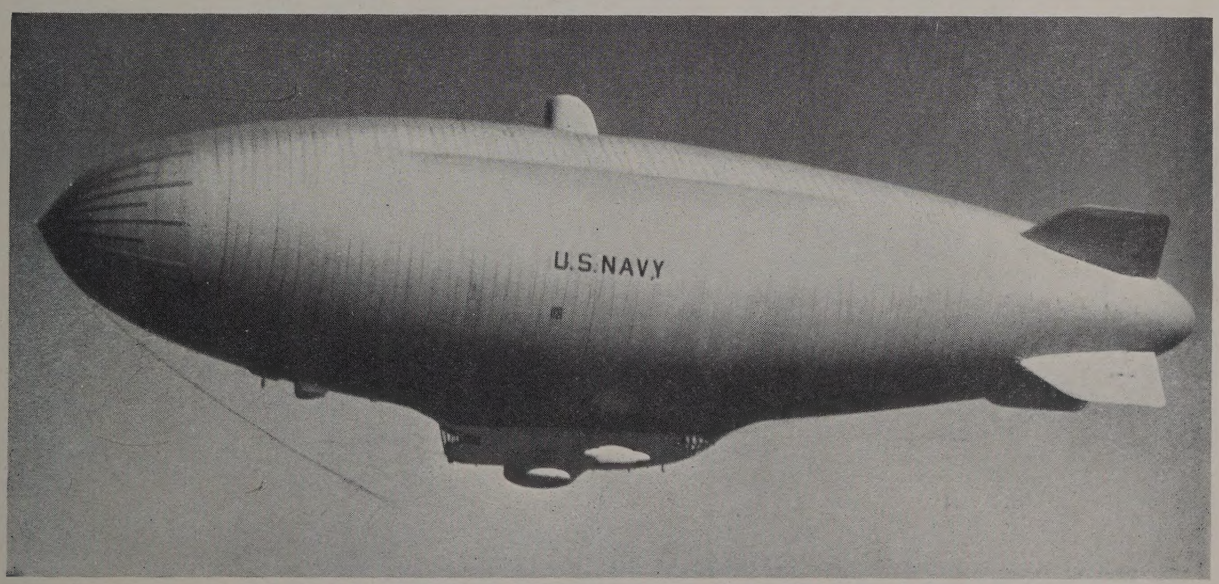
A notable feature of the new ship is the inverted "Y" configuration of the three control surfaces aft, an arrangement evolved to prevent the accumulation of snow on the side control surfaces.

The ZS2G-1 is equipped with the latest developments adaptable to such craft for detecting, locating and attacking submarines. The airship can refuel in flight from surface craft and re-ballast by a water pick-up system. A crew of eight is carried.

An undisclosed number of ZS2G-1 ships are being built for the U.S. Navy. Car construction and assembly is undertaken at Goodyear's Akron factory, while the envelopes are being made at the company's Litchfield Park, Arizona, factory.

THE GOODYEAR ZPG-2.

The first new patrol ship to be built since the war was the ZPN-1, now designated ZPG-1, which was flown for the first time in 1951. As the result of extensive evaluation trials with this ship an improved and slightly larger version, the ZP2N-1, was put into production,



The Goodyear ZPG-2W Early Warning version of the ZPG-2 Patrol Airship.

the first P2N ship, since re-designated ZPG-2, making its maiden flight on March 20, 1953.

The ZPG-2 has a helium capacity of 975,000 cub. ft. (27,590 m.³). It is powered by two 800 h.p. Wright R-1300-2A radial air-cooled engines mounted in an engine room within the car and driving through shafts and gearing two 16 ft. 7 in. (5.06 m.) Curtiss Electric three-blade controllable-pitch, feathering and reversible airscrews mounted on outriggers projecting from each side of the car. In an emergency either engine can drive both airscrews. Both engines are accessible for maintenance and repair in flight, if necessary.

The control car, which accommodates a crew of fourteen officers and ratings, has two decks, with all operational stations on the lower deck and crew's quarters on the upper deck.

The tricycle landing-gear, comprising a nose wheel and two larger wheels, one under each airscrew outrigger, is retractable.

The four control surfaces on the stern of the ship are mounted at 45 degree angles from the vertical and horizontal and as all surfaces are operated in unison for either vertical or horizontal control they are known collectively as "rudde-vators."

The flight controls are subject to manual or automatic pilot operation. The pilot may control both vertical and horizontal direction alone or. in co-operation with a co-pilot, may divide the duties of maintaining altitude and direction. All controls can be operated through a single column, which is duplicated at the pilot and co-pilot stations.

The ZPG-2 has the latest developments adaptable to aircraft for locating and attacking submarines.

Special equipment will permit the ship to refuel in flight from a surface craft or to re-ballast from the ocean through a water pick-up system.

The ship's envelope is made of Neoprene-coated cotton and the control car is constructed of a sandwich material comprising a balsa wood core faced with aluminium-alloy sheet.

The first ZPG-2 set up a new World's Endurance Record in May, 1954, by remaining in the air for 200.4 hours. This record was exceeded in 1957 by another ZPG-2 ship, which remained in the air without refuelling from March 4 to March 15 for a total time of 264 hours 14 minutes.

For further details see Table.

THE GOODYEAR ZPG-2W.

The ZPG-2W is an AEW (Aircraft Early Warning) version of the ZPG-2 which was initially designed for anti-submarine operations. The 2W modification incorporates changes in the electronic equipment and the addition of a large radome, containing special electronic devices for aircraft detection, on top of the envelope. A 75-foot vertical tunnel of rubberised fabric with stiffeners is built inside the envelope to connect the electronic station on top of the envelope with the control car. In all other respects the ZPG-2W is similar to the previously-described ZPG-2.

GOODYEAR AIRSHIPS BUILT FOR THE U.S. NAVY.

Class	Volume	Length	Height	Width	Engines	Max. Speed m.p.h. (km.h.)	Remarks
ZSG-2 and ZSG-3	527,000 cub. ft. (14,915 m.³)	267 ft. (81.4 m.)	84 ft. (25.6 m.)	70 ft. (21.3 m.)	2×550 h.p. Pratt & Whitney Wasp	over 75 m.p.h. (120 km.h.)	Originally K Class ships, the first of which was launched on December 8, 1938. 130 built during last war. U.S. Navy has modified many K ships to ZSG-2 (formerly P2K) and ZSG-3 (formerly P3K) standards with latest electronic equipment and increased power (550 h.p. Pratt & Whitney Wasp engines). Now used for training.
ZSG-4	527,000 cub. ft. (14,915 m.³)	267 ft. (81.4 m.)	84 ft. (25.6 m.)	70 ft. (21.3 m.)	2×550 h.p. Pratt & Whitney Wasp	over 75 m.p.h. (120 km.h.)	Development of former K Class as an intermediate search craft. Prototype flew in December, 1953. In production.
ZS2G-1	650,000 cub. ft. (18,200 m.³)	285 ft. (86.9 m.)	92 ft. (28.0 m.)	68 ft. (20.7 m.)	2×800 h.p. Wright R-1300-4 Cyclone 7	over 85 m.p.h. (136 km.h.)	Newly-designed replacement of the former K Class ships. No details available for publication. Prototype flew on July 22, 1954. In production.
ZPG-1	875,000 cub. ft. (24,760 m.³)	324.4 ft. (98.8 m.)	94.5 ft. (28.8 m.)	73.5 ft. (22.4 m.)	2×800 h.p. Wright R-1300-2A Cyclone 7	over 85 m.p.h. (136 km.h.)	Completed in 1951. Prototype only.
ZPG-2	975,000 cub. ft. (27,590 m.³)	343 ft. (104.6 m.)	96.5 ft. (29.4 m.)	75.5 ft. (23.0 m.)	2×800 h.p. Wright R-1300-2A Cyclone 7	over 85 m.p.h. (136 km.h.)	First production ZPG-2 made its first flight on March 20, 1953. ZPG-2 ships have established two World's endurance records, the first in May, 1954, at 200.4 hours and the second in March, 1957, at 264.2 hours, both without refueiling.
ZPG-3W	—	—	—	—	—	—	Larger version of ZPG-2W (see above).

Printed in England by
NETHERWOOD DALTON & Co. Ltd.
HUDDERSFIELD

REFERENCE ONLY

• RANGEFINDERS • BINOCULARS • ELECTRONIC INSTRUMENTS • GUNNERY CONTROL INSTRUMENTS • AEROPLANE GUNSIGHTS • RENCE LIGHT FILTERS • VEL GEARS • PRECISION MECHANISMS •

Messrs. Barr & Stroud Limited

specialise in the design and manufacture of high precision machines and instruments, Mechanical, Optical and Electronic, for Navy, Army and Air Force. Their extensive works are fully equipped with modern plant, permitting rapid quantity production of the highest quality.

Their Research Laboratories and Development Departments are controlled and staffed by highly trained Mechanical Engineers, Physicists and Electronics Engineers, experienced in carrying out projects of wide variety and complexity.

Founded in 1888
by
Professor Archibald Barr
Professor William Stroud

BARR & STROUD

LIMITED

WORKS: ANNIESLAND, GLASGOW, W.3.
Telephone: SCOTSTOUN 4241. *Telegrams:* "Telemeter, Glasgow".

London Office: 15 Victoria Street, Westminster, S.W.1.
Telephone: ABBey 6433. *Telegrams:* "Retemelet, Phone, London"

CONTRA COSTA COUNTY LIBRARY
3 1901 00735 7363